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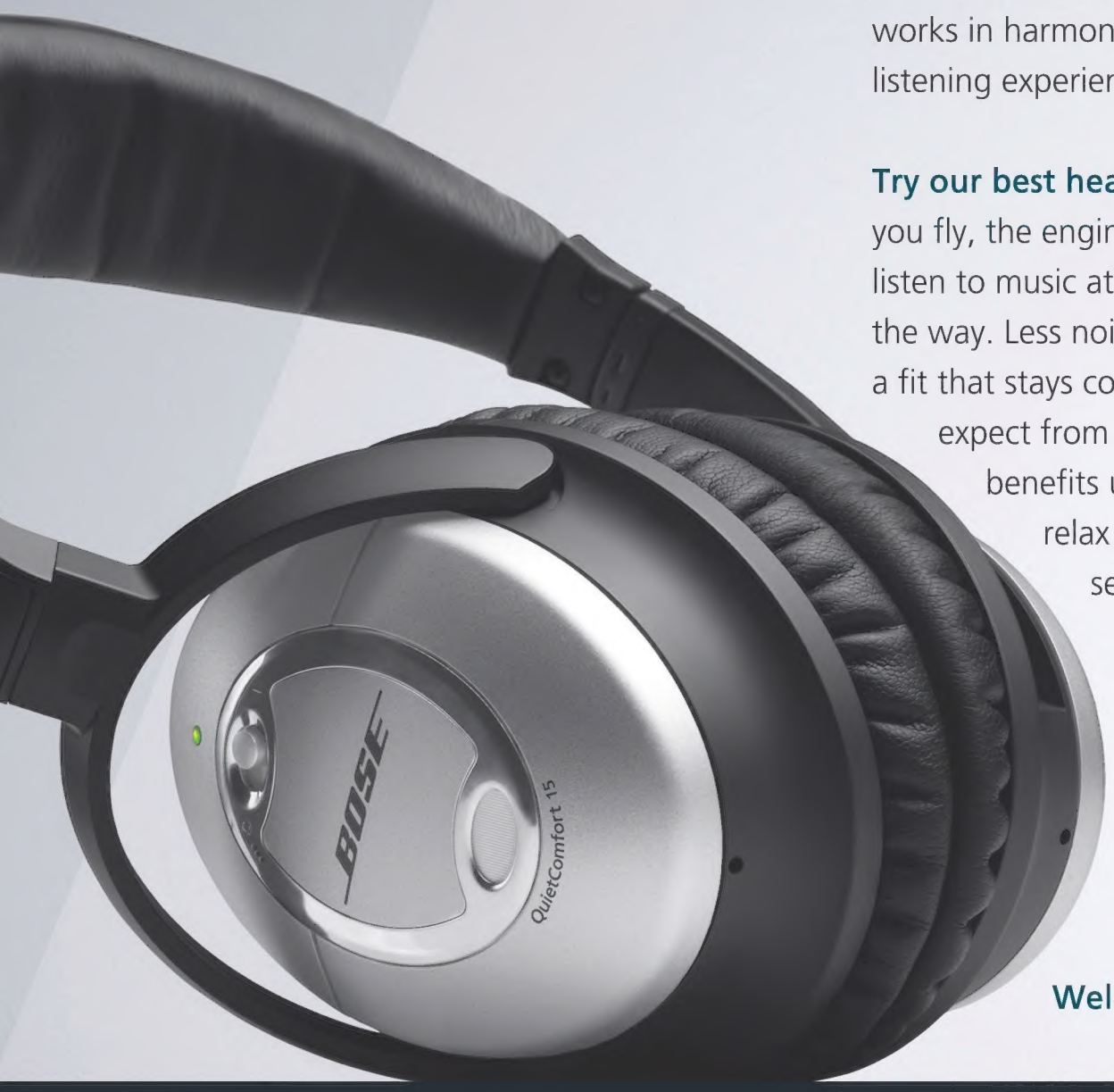

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EDITORIAL OFFICES:
MRC 513,
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SUBSCRIPTIONS:
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Palm Coast, FL 32142-0312
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FROM THE EDITOR

Reorientations

Cowboy Culture and the Universe

BY CAREY WINFREY

Panek: "It hasn't really sunk in."

FOR HIS ARTICLE "Probing the Biggest Mystery in the Universe" (p. 30), journalist Richard Panek went all the way to the South Pole, where he was surprised by its incredible flatness. "I've just never seen a landscape like it," he says, "and I grew up in the Midwest. There was absolutely nothing on the horizon. It's just barren and beautiful for that." He was even more surprised by how little the astronomers he talked to at the pole actually understood the subject he went there to report: dark energy, which may be the most powerful force in the universe. "They are kind of saying there is something there, but we don't know what it is. For me, it's mind-blowing that what we've always thought of as the universe is only 4 percent of what's out there; that requires as profound a rethinking as the Copernican revolution. Or, it's like we're back in 1610, when Galileo comes out and says there are moons around Jupiter and everybody goes 'Wow! That's wild. What else is out there?' I feel we're at that stage now with dark energy. People may have heard about it, but they don't really appreciate the implications of reorienting our entire relationship to the universe. It hasn't really sunk in. So that's what I'm trying to do in my work now."

Laskas: "OK, I'm going."

DEBORAH COPAKEN KOGAN; SCOTT GOLDSMITH

FOR NEARLY 15 YEARS, Jeanne Marie Laskas wrote a syndicated column for *The Washington Post Magazine*, before giving it up to return to the kind of heavily reported journalism that she loves. "I like to immerse myself in cultures that people don't know too much about—coal miners, oil riggers, air traffic controllers—that we're all dependent on." (Her sixth book, *Hidden America: The Unseen World of People Who Make Everything Work*, is due out next year.) For SMITHSONIAN, Laskas wrote about the men and women who bring beef—some 62 pounds per person per year in this country—to our tables ("The Best Bull Ever?" p. 74). "I liked that it's an industry that connects the old world with the new—the family farmer with the latest technologies," she says. "It just seemed to be a story that covered so much ground, in terms of history, science and the mythical cowboy culture that we all know about from movies. We think it doesn't exist anymore, but it does. When I found out there were cowboys, I thought, 'OK, I'm going.' " I think you'll be glad, as we are, that she did.

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LETTERS READERS RESPOND TO THE **FEBRUARY** ISSUE

Smithsonian
MYSTERIES OF THE SPHINX
Can Auschwitz Be Saved?
Sixty-five years after the concentration camp was liberated, the Polish government is struggling to preserve the decaying historic site that draws millions of visitors
BY ANDREW CURRY

Humans built those infernal death factories ["Can Auschwitz Be Saved?"] and humans now bear the burden, not just of memory, but of explanation. Parts of the site will molder and must be allowed to, if only to show the fragility of life. Auschwitz is no more indestructible than we are.

CAITLIN MEREDITH, TRINITY, NC

A STAIN ON HISTORY

IN 2008, I visited the concentration camps at Auschwitz and Birkenau. My experience was one I wish more Americans could share. Standing there, seeing piles of tiny shoes, the grooves in the door of a cell that starving men carved with their fingers—these are the things you never forget. Yes, the fleeing Nazis destroyed buildings in an effort to erase evidence of the evils committed there. But the craters and rubble left behind impress the history of the place upon all its visitors—they were unable to remove that stain from human memory. Are we now to do their work by allowing the camp to disintegrate? We need these places. We need to remember the horrors human beings are capable of inflicting upon one another.

ANNE MARIE SOHLER
MERCHANTVILLE, NEW JERSEY

AN AMERICAN DREAM

"MIGRATIONS FORCED AND FREE," about how post-1965 African and Caribbean immigrants challenge what it means to be African-American, reminded me of Dr. Martin Luther King Jr.'s dream of a nation where his children "will not be judged by the color of their skin but by the content of their character." Race is a human construct. Organisms seek diversity. This is how a species makes itself better able to survive. But we still cling to the labels African-American, Asian-American, White. In 100 years, I hope you can do an article called "The Last Hyphenated American," which will give a perspective on the history that caused us to exist in divided camps. Hopefully, King's dream will then be realized and the dysfunction that has plagued America will be relegated to history.

MARK MAGAS
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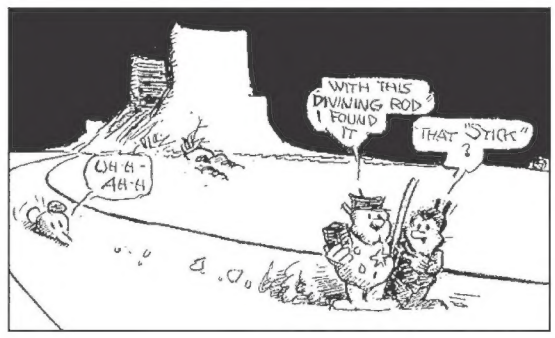
"KRAZY KAT'S" WEST

THE EXCELLENT article "Behind the Scenes in Monument Valley" described how one great artist, director John Ford,



came to love and depict the valley. But when Ford was still working as an assistant director on silent films, Monument Valley appeared daily as the backdrop to "Krazy Kat," the brilliant comic strip created by George Herriman. Herriman requested that his ashes be scattered in the valley after his death and cremation in 1944. He isn't appreciated so much in these days of manga and 3-D animated films, but he remains one of the geniuses of cartooning.

RICHARD A. MESTIS
MARYSVILLE, WASHINGTON

HONORABLE EXCEPTIONS

THE HUMOROUS "Stamp Tact" cites the U.S. Postal Service rule that "no living person shall be honored by portrayal on U.S. postage." But three living persons were pictured on a 1945 U.S. postage stamp: Ira Hayes, Rene Gagnon and John Bradley. They were among the men who raised the American flag atop Mount Suribachi during the Battle of Iwo Jima on February 23, 1945. The other men shown were subsequently killed in action before the stamp was issued, in July 1945.

DICK DRESELLY
BRUNSWICK, MAINE

A stamp historian explains that likenesses of living persons were prohibited on stamps and other securities by an 1866 bill. As the Postal Service interprets the law, a likeness appearing incidentally while honoring a heroic event may be permitted. Thus the Iwo Jima stamp of 1945 and the "Heroes of 2001" stamp. It showed firefighters hoisting the flag above Ground Zero and honored the heroism of emergency-relief personnel killed or disabled while responding to the 9/11 terrorist attacks. In addition, the Postal Service accepts stamps printed by third parties, including Web sites that make use of uploaded digital snapshots; such customized stamps may be adorned with the image of a living person because they are not made by the government.—Ed.

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"KRAZY KAT," JUNE 4, 1944, ©KING FEATURES SYNDICATE, INC.

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On the Waterfront

Baltimore photographer A. Aubrey Bodine captured the dignity of work in painterly tones **BY ABIGAIL TUCKER**

THE MAN HABITUALLY carried a compass to find the sun on cloudy days; toilet paper to diffuse the light of his flashbulbs; and a machete to deal with unsightly vegetation—and heaven knows what else—that got in his way. But A. Aubrey Bodine once said his favorite tool was his alarm clock.

To take advantage of morning light, the Maryland photographer often rose before dawn and set out for the Baltimore waterfront, where the big freighters might be ferrying sugar, bananas or, as on the day *Longshoremen* was shot in 1955 at the B&O railroad pier, rubber. "He'd go down there in the middle of the night sometimes, with thousands of dollars of camera equipment," his daughter Jennifer recalls. "It was a violent, filthy, terrifying place." But *Longshoremen* belies the port's industrial ugliness. With spotlight-like sunshine, it is as elegant as a theater set, the draped cargo net adding the nautical touch that Bodine loved.

The image ran in the Sunday *Baltimore Sun*, where Bodine, a staff photographer, published almost all his work; it also won prizes in competitions around the world, particularly in the Eastern bloc. Politically, Bodine stood somewhere "to the right of Ivan the Terrible," according to his editor and biographer, the late Harold Williams, but he shared the communists' reverence for the worker. Farmers driving yokes of oxen, grimy miners and, especially, dockworkers and watermen—Bodine shot them all. He was an indefatigable laborer himself, taking nearly 50,000 photographs before

"He'd go down there [to the docks] in the middle of the night sometimes," Bodine's daughter says.

"I do not cover fires or anyone bitten by a dog," Bodine (right: c. 1940) said. Still, he seemed to be always working, says his daughter Jennifer (far right: in March 2009; above: in a 1955 Bodine portrait with housekeeper Gussie Gordon).

his death, at age 64, in 1970. In an era when newspaper photos were usually uncredited, Bodine demanded a byline, and before long it was known throughout the state and beyond.

Yet he remained secretive about the initial "A." It stood for Aldine.

He started at the *Sun* as a 14-year-old messenger boy in 1920. He caught a break in 1924, when one of the paper's commercial photographers was scorched in a flash-powder explosion. Even without volatile equipment, photography was a risky enterprise; Bodine loved shooting the Chesapeake Bay, but he couldn't swim and was forever clinging to the masts of oyster boats, saddled with a large-format camera as heavy as a millstone. Yet he practiced his craft relentlessly, accepting newspaper assignments not only on his wedding morning but on his honeymoon as well. He began shooting primarily for the *Sun*'s Sunday photography section in 1927 and its Sunday magazine in 1946.

According to even his closest friends, he was not a sociable man. "I do not cover fires or anyone bitten by a dog," he once declared, apparently oblivious to the feelings of newsroom colleagues who did. One of them remarked that had Bodine drowned on one of his water shoots, his "body would have floated upstream." Yet he was admired. "He had it all figured out," says Walter McCardell, who joined the *Sun*'s photography staff in 1945. "He learned what time the sun rose. I think he knew the tides." McCardell once tagged along with him on a predawn shoot, "but Bodine didn't like how the sun was coming up." After the sun misbehaved for two more mornings, McCardell elected to stay in bed.

Bodine preferred idyllic scenes. He was a pictorialist, part of a photographic movement dating from the late 1800s that favors a painterly aesthetic. Pictorialists freely manipulate their subjects; Bodine thought nothing of removing eyesores, adding props and posing people—including the dockworkers in *Longshoremen*, according to Kathleen Ewing, author of *A. Aubrey Bodine: Baltimore Pictorialist*. If he still wasn't satisfied, the darkroom offered myriad remedies. He was adept at dubbing in sea gulls or brightening the whitecaps on waves. He kept a fishing tackle box full of cloud negatives for enlivening lackluster skies. Some of his practices would be firing offenses at newspapers today, but they were a more acceptable part of feature photography then.

At home, Bodine—which is what even his daughter Jennifer calls him—covered the dining room table with his fresh prints, so the family frequently ate in the kitchen. Gold toner filled the bathtub; the Bodines bathed next door. He was out on assignment throughout Jennifer's childhood, or so it seemed. When he was home, she prayed he wouldn't be the one to drive her to a birthday party—too often he would spot a picture on the way and pull the car over, delivering her, pouting in patent leather and crinoline, hours late.

Health problems, including diabetes and hypertension, shadowed Bodine's later years, but he was undeterred. During one hospital stay, Williams writes, a night watchman discovered him on the roof in his bathrobe, shooting Baltimore's moonlit skyline. During another, Bodine was found in the lobby, where some of his photographs were displayed. He set about autographing each one until a nurse telephoned the psychiatric ward. "I think one of your patients is down here," she said, "pretending he's Aubrey Bodine."

On the last day of his life he went out to photograph a church spire, another favorite subject, but returned to the office empty-handed, telling editors that the light had "conked out" on him. He then retreated to the darkroom, where he collapsed. He died of a massive stroke.

Jennifer—who named her only child, a girl, Bodine—now spends her time cataloging her father's endless prints: the record of where he was all those years.

ABIGAIL TUCKER *is the magazine's staff writer.*

A. AUBREY BODINE (2); MOLLY ROBERTS / *SMITHSONIAN*; PP. 8-9 A. AUBREY BODINE

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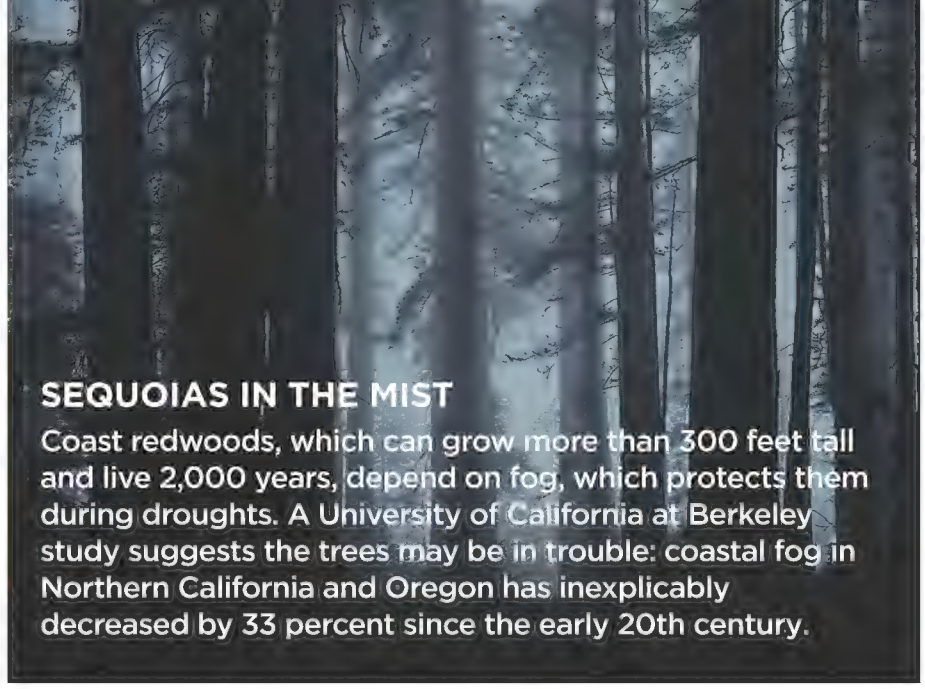
WILD THINGS

LIFE AS WE KNOW IT

BY AMANDA BENSEN,
T.A. FRAIL, MEGAN GAMBINO,
ERICA R. HENDRY AND SARAH ZIELINSKI



SEQUOIAS IN THE MIST

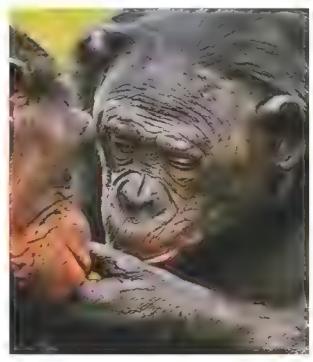
Coast redwoods, which can grow more than 300 feet tall and live 2,000 years, depend on fog, which protects them during droughts. A University of California at Berkeley study suggests the trees may be in trouble: coastal fog in Northern California and Oregon has inexplicably decreased by 33 percent since the early 20th century.

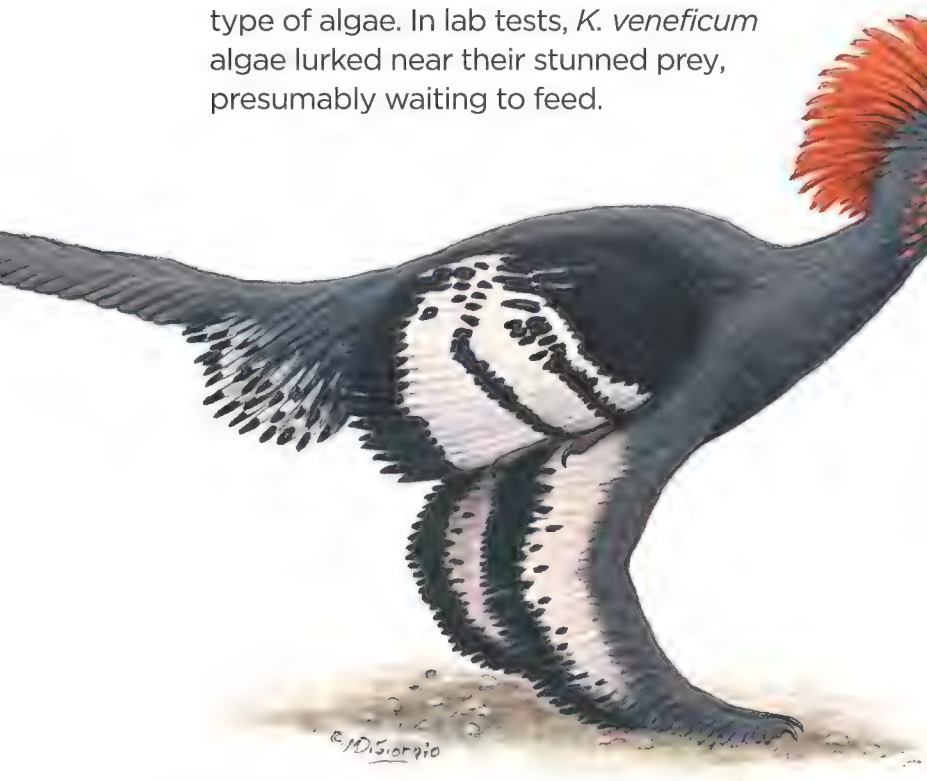
BLOOMIN' TIDE

When certain marine algae proliferate or "bloom," they can release toxins that kill fish—and even sicken beachgoers. Scientists believed the toxins primarily deterred fish that prey on the algae themselves. But a new University of Minnesota-led study says the widespread algae *Karlodinium veneficum* (inset), which cause blooms called "brown tide," release toxins to paralyze another type of algae. In lab tests, *K. veneficum* algae lurked near their stunned prey, presumably waiting to feed.

SHARE AND SHARE ALIKE

Bonobos have what was thought to be a uniquely human trait: they share. Researchers in Congo tested the great apes by placing one bonobo in a room that had food and another bonobo in an empty room next-door. The one with the food usually invited the other over for a bite to eat. (Chimpanzees, a closely related species, don't do this.) Bonobo generosity wasn't dependent on kinship, pressure or past favors. Instead the animals may have expected a favor in return or they may have had "a more altruistic motivation."





LIVING COLOR

Paleontologists have speculated that dinosaurs weren't drab, but how were they actually colored? A 156-million-year-old feathered theropod, *Anchiornis huxleyi*, is the subject of the first scientific reconstruction of a dinosaur's color pattern (left). Researchers analyzed cellular structures called melanosomes in an exquisitely preserved fossil from China and compared them with similar structures in modern birds. The four-winged dinosaur had a coppery crest, a speckled face and white-striped wings.

Observed

NAME: The horse (*Equus caballus*), specifically the white horse.
AMONG HUMANS: Prized.
AMONG FLIES: Not so much.
AMONG HORSES: White-coated horses are more susceptible to skin cancer and vision problems than more darkly pigmented herd mates. But this is a mixed curse, researchers studying a herd in Hungary have found. Blood-sucking, disease-spreading flies that prey on horses find their victims in part by detecting the polarized light reflected by the horses' coats. White coats reflect light differently, making them less vulnerable to fly attacks.

JAMES P. BLAIR / NATIONAL GEOGRAPHIC STOCK; VINCE LOVKO; FRANS LANTING / WWW.LANTING.COM (CAPTIVE); MICHAEL DIGIORGIO / YALE UNIVERSITY; WILD WONDERS OF EUROPE / ALLOFS / NATUREPL.COM

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BAT BENEFITS

I'm always grateful to look up at sunset and see our local big brown bats arriving from the woods behind our house to deal with the mosquito onslaught. I am also grateful to the dedicated bat researchers who strive to study and learn about bats.

—Celeste Butler on "Call of the Panama Bats"

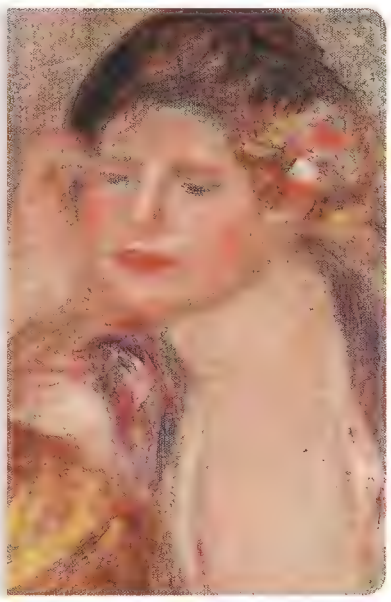
Smithsonian.com/bats

RENOIR'S LOVE

He was painfully crippled and already wealthy. The only reason for works like this (detail from *The Serenade*) was love of his art. There is room for admiration on this basis alone.

—Jane Willenberg on "Renoir's Controversial Second Act"

Smithsonian.com/renoir



HOOFING IT

I stopped running with shoes on my treadmill almost a year ago and I would never consider buying another pair. I haven't experienced any problems. The benefits are amazing.

—Margarita Muñoz, Brooklyn, New York, on "The Barefoot Running Debate," in the Surprising Science blog Smithsonian.com/running

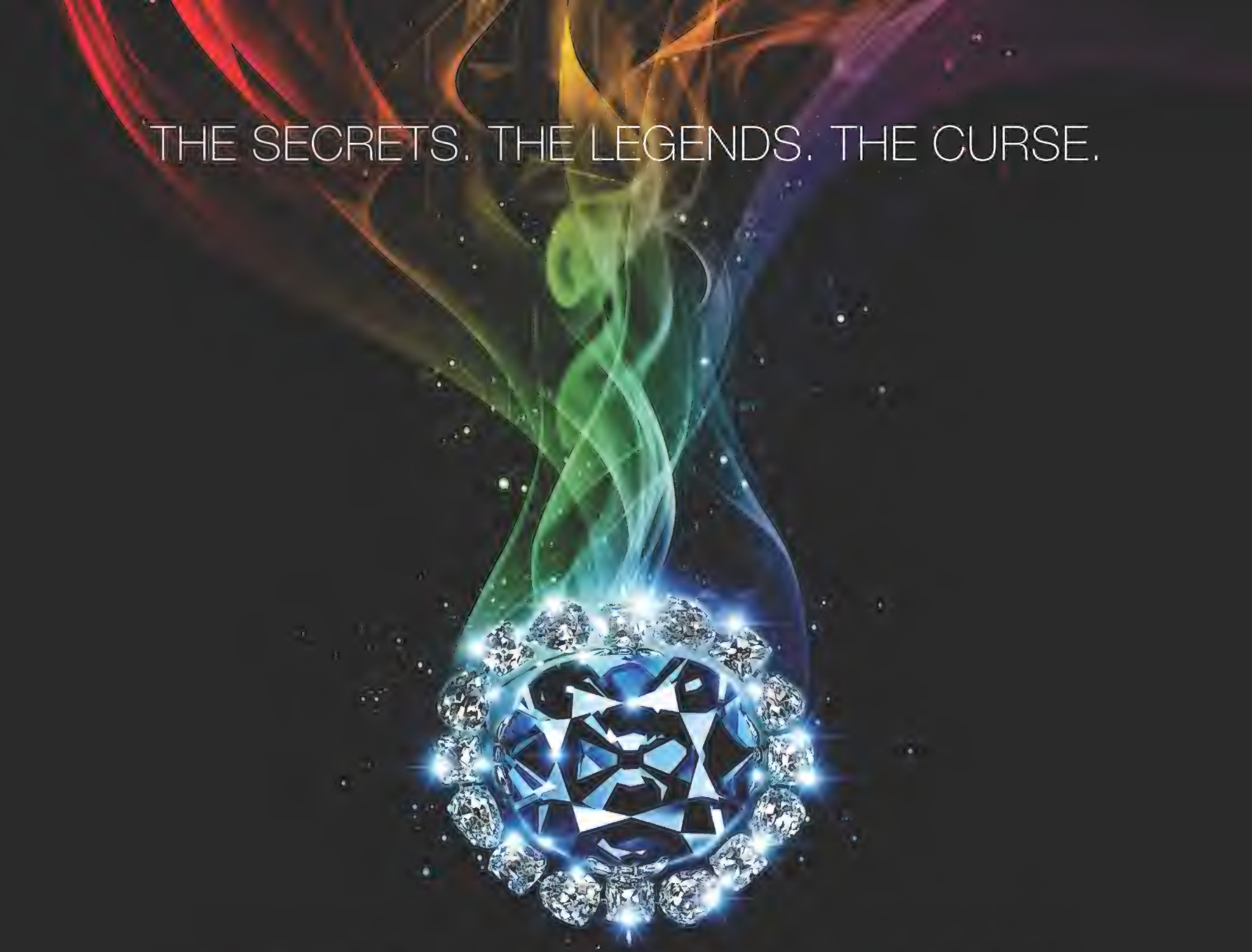
YUMA IS, and always has been, a crossroads, so people appreciate newcomers as well as those who have lived here for generations. Being on the border with California and only ten minutes from Mexico, it is a great place for world travelers to call home. Yuma boasts at least five performing dance companies, an arts center (above), an orchestra, arts festivals and an abundance of artists. My children grew up seeing the Moscow Ballet, knowing who Frank Lloyd Wright was and hearing classical as well as Broadway, jazz, contemporary and other forms of music. They have gotten to travel to Mexicali's annual Festival of the Sun and hear opera; to San Diego and Balboa Park's natural history and art museums; to Los Angeles and the Getty Museum—all within driving distance. Yuma has the benefits of the country and the city.

YOUR KIND OF TOWN

YUMA, ARIZONA
BY ANTONIA BADONE

Submit your kind of town story or photograph and find others at Smithsonian.com/yourkindoftown

MICHAEL DURHAM / MINDEN PICTURES; PAIGE LINEBERRY; PIERRE-AUGUSTE RENOIR, *THE SERENADE*, 1919 / MCNAY ART MUSEUM / ART RESOURCE, NY (DETAIL); ANN JOHANSSON / CORBIS



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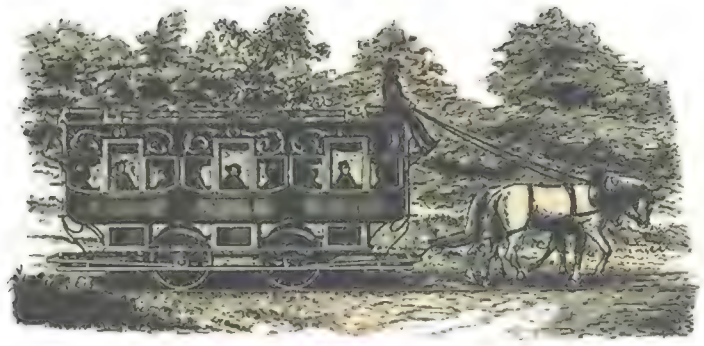

Ireland's Forgotten Sons

In Pennsylvania, amateur archaeologists have discovered the fate of immigrant railroad workers who disappeared nearly two centuries ago **BY ABIGAIL TUCKER**

BURIED IN A GREEN Pennsylvania valley for nearly two centuries, the man had been reduced to a jumble of bones: skull, vertebrae, toes, teeth and ribs. Gradually, though, he came alive for William and Frank Watson, twin brothers who are leading an excavation at a pre-Civil War railroad construction site outside Philadelphia, where 57 Irish workers are said to have been surreptitiously interred in a mass grave.

The plates of the man's skull were not fully fused, indicating he was a teenager when he died. He was relatively short, 5-foot-6, but quite strong, judging from his bone structure. And X-rays showed he never grew an upper right first molar, a rare genetic defect. The Watsons have tentatively identified him as John Ruddy—an 18-year-old laborer from rural County Donegal, who sailed from Derry in the spring of 1832. He likely had cholera, alongside dozens of his countrymen, all dying within two months of setting foot on American shores.

Tipped off by a long-secret railroad company document, the Watsons searched the woods around Malvern, Pennsylvania, for four and a half years to find "our men" (as they call the workers) before locating the Ruddy skeleton in March 2009. They have since unearthed the mingled remains of several others and believe they know the location of the rest. William is a professor of medieval history at Immaculata University; Frank is a Lutheran minister. Both belong to Irish and Scottish cultural societies (they are com-

During the era of horse-drawn railroads (top), workers filled in a ravine at Duffy's Cut (below- a gravesite).

WILLIAM WATSON COLLECTION; RYAN DONNELL

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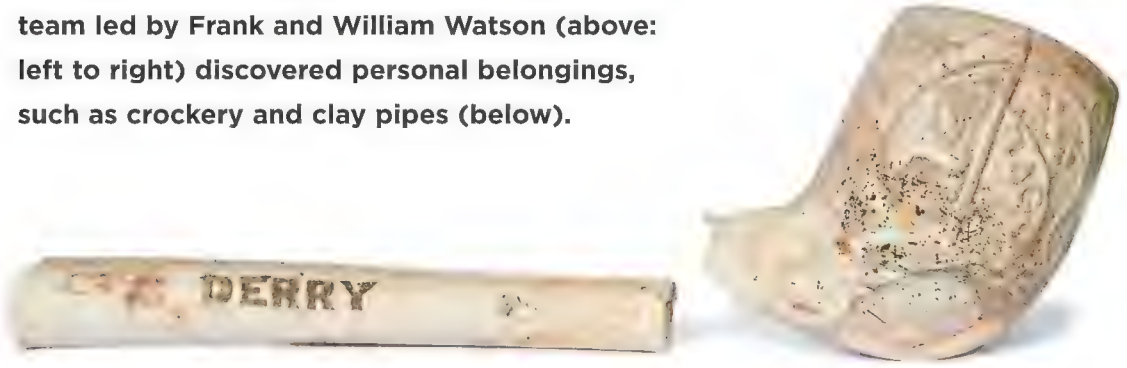

In addition to unearthing human remains, the team led by Frank and William Watson (above: left to right) discovered personal belongings, such as crockery and clay pipes (below).

collection of letters and other documents Clement assembled during a 1909 company investigation—described an 1832 cholera outbreak that swept through a construction encampment along a stretch of railroad that would connect Philadelphia with Columbia, Pennsylvania. Contemporary newspapers, which usually kept detailed tallies of local cholera fatalities, implied that only a handful of men had died at the camp. Yet Clement's inquiry concluded that at least 57 men had perished. The Watsons became convinced the railroad covered up the deaths to ensure the recruitment of new laborers.

Work on the Philadelphia and Columbia line, originally a horse-drawn train, began in 1828. Three years later, a contractor named Philip Duffy got the nod to construct Mile 59, one of the toughest stretches. The project required leveling a hill—known as making a cut—and using the soil to fill in a neighboring valley in order to flatten the ground. It was nasty work. The dirt was "heavy as the dickens," says railroad historian John Hankey, who visited the site. "Sticky, heavy, a lot of clay, a lot of stones—shale and rotten rock."

Duffy, a middle-class Irishman, had tackled previous railroad projects by enlisting "a sturdy looking band of the

"Every once in a while we would sit down and ask ourselves: '*Are* we crazy?'" Frank adds. "But we weren't."

petitive bagpipers), but neither had any prior archaeological training.

"Half the people in the world thought we were crazy," William says.

"Every once in a while we would sit down and ask ourselves: '*Are* we crazy?'" Frank adds. "But we weren't."

Today their dig is shedding light on the early 19th century, when thousands of immigrants labored to build the infrastructure of the still-young nation. Labor unions were in their infancy. Working conditions were controlled entirely by the companies, most of which had little regard for the safety of their employees. The Pennsylvania grave was a human "trash heap," Frank says. Similar burial sites lie alongside this country's canals, dams, bridges and railroads, their locations known and unknown; their occupants nameless. But the Watsons were determined to find the Irishmen at the site, known as Duffy's Cut. "They're not going to be anonymous anymore," William says.

The project began in 2002 when the Watsons began reviewing a private railroad company file that had belonged to their late grandfather, the assistant to Martin Clement, a 1940s-era Pennsylvania Railroad president. The file—a sons of Erin," an 1829 newspaper article reported. By 1830, census records show that Duffy was sheltering immigrants in his rental home. Like many laborers from Ireland's rural north, Duffy's workers were probably poor, Catholic and Gaelic-speaking. Unlike the wealthier Scotch-Irish families who preceded them, they were typically single men traveling with few possessions who would perform punishing jobs for a pittance. The average wages for immigrant laborers were "ten to fifteen dollars a month, with a miserable lodging, and a large allowance for whiskey," the British nov-

RYAN DONNELL (3)

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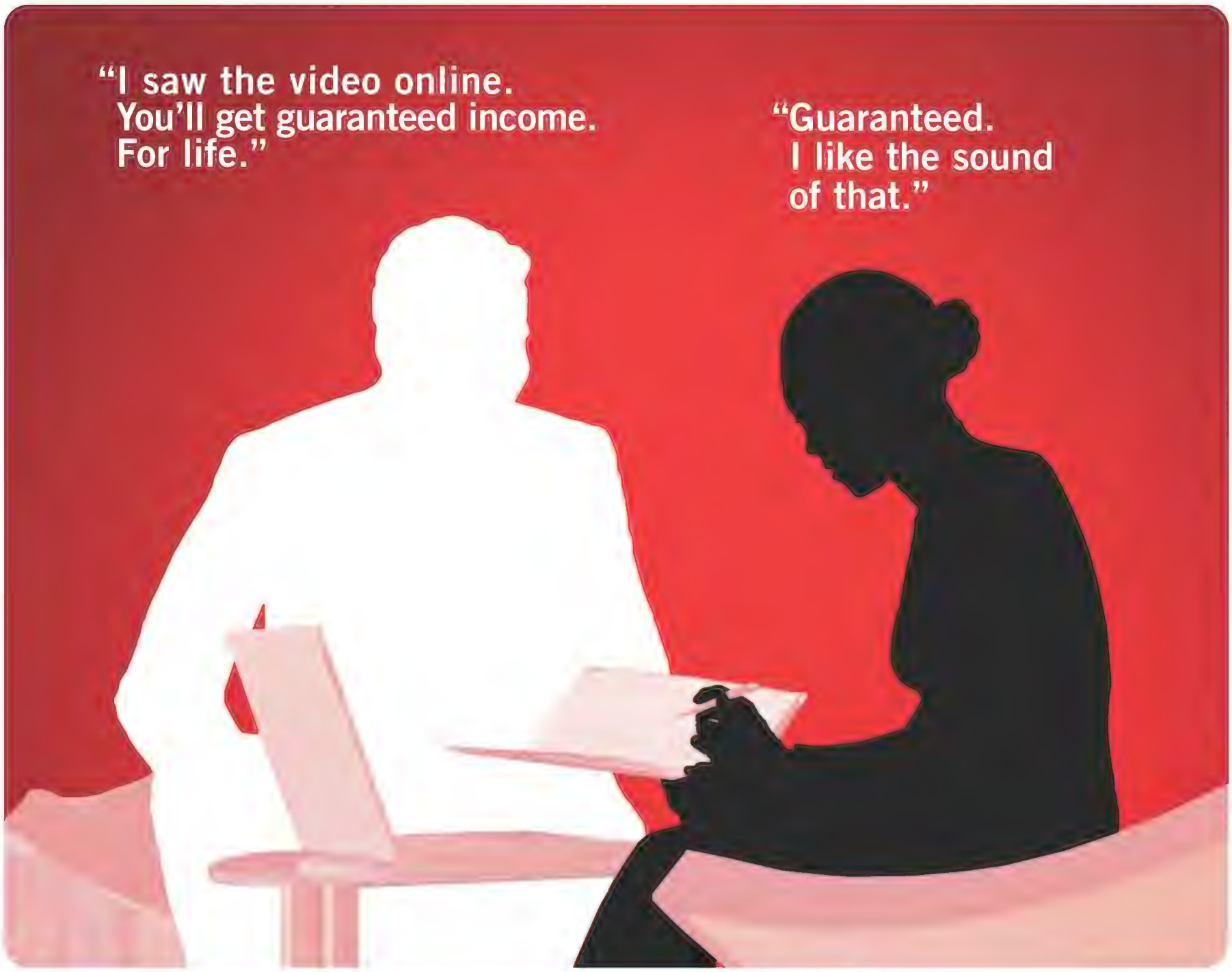

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elist Frances Trollope reported in the early 1830s.

When cholera swept the Philadelphia countryside in the summer of 1832, railroad workers housed in a shanty near Duffy's Cut fled the area, according to Julian Sachse, a historian who interviewed elderly locals in the late 1800s. But nearby homeowners, perhaps fearful of infection (it was not yet known that cholera spreads through contaminated water sources), turned them away. The laborers went back to the valley, to be tended only by a local blacksmith and nuns from the Sisters of Charity, who went to the camp from Philadelphia. Later the blacksmith buried the bodies and torched the shanty.

That story was more legend than history in August 2004 when the Watsons began digging along Mile 59, near modern Amtrak tracks. (They'd obtained permission from local homeowners and the state of Pennsylvania to excavate.) In 2005, Hankey visited the valley and guessed where the workers would have strung their canvas shelter: sure enough, the diggers found evidence of a burned area, 30 feet wide. Excavations turned up old glass buttons, pieces of crockery and clay pipes—including one stamped with the image of an Irish harp.

On a recent afternoon, the valley was quiet, except for the scrape and clatter of shovels, the slap of wet dirt in the bottom of a wheelbarrow, and every now and then the shuddering shriek of a passing train. The terrain would challenge even professional excavators: the embankment is steep and the roots of a huge tulip poplar have fingered their way through the site. The team's pickaxes and spades are not much more sophisticated than the Irishmen's original tools. "We are unbuilding what they died to build," William Watson says.

The gap between teeth on a jaw fragment is a clue to the rail worker's likely identity: 18-year-old John Ruddy.

RYAN DONNELL

When cholera swept the countryside, the workers fled the area, but were turned away by nearby homeowners.

But no bodies. Then Frank Watson reread a statement in the Clement file from a railroad employee: "I heard my father say that they were buried where they were making the fill." Was it possible the bodies lay beneath the original railroad tracks? In December 2008, the Watsons asked geoscientist Tim Bechtel to concentrate his ground-penetrating radar search along the embankment, where he detected a large "anomaly," possibly an air pocket formed by decomposed bodies. Three months later, shortly after St. Patrick's Day, a student worker named Patrick Barry struck a leg bone with his shovel.

The Watson brothers hope to recover every last body. In doing so, they could provoke fresh controversies. Some of the men might have been murdered, says Janet Monge, a University of Pennsylvania forensic anthropologist who is analyzing the remains. At least one and perhaps two of the recovered skulls show signs of trauma at the time of death, she says, adding these may have been mercy killings, or perhaps local vigilantes didn't want more sick men leaving the valley.

Identifying the bodies is a challenge, because the laborers' names are absent from census records and newspaper obituaries. And, says William Watson, the archives of the Sisters of Charity offer only a "spotty" account. The most promising clue is the passenger list of a ship, the *John Stamp,* the only vessel in the spring of 1832 to come from Ireland to Philadelphia with a good many Irish laborers aboard—including a teenager, John Ruddy of Donegal. Many of these immigrants did not show up in subsequent census records.

The news media in Ireland have reported on the Duffy's Cut dig since 2006. This past year, as word of the discovery of the skeleton of Ruddy made headlines, the Watsons received phone calls and e-mails from several Ruddys in Ireland, including a Donegal family whose members exhibit the same congenital defect found in the skeleton. Matthew Patterson, a forensic dentist who worked with the Watsons, says the genetic abnormality is "exceptionally rare," appearing in perhaps one in a million Americans, though the incidence may be greater in Ireland.

The Watsons are confident they have found the family John Ruddy left behind nearly two centuries ago. But to be certain, the brothers are raising money for genetic tests to compare DNA from the skeleton with that of the Donegal Ruddys; if there's a match, Ruddy's remains will be sent back to Ireland for a family burial. Any unclaimed remains the Watsons disinter will be buried beneath a Celtic cross in West Laurel Hill cemetery, where they will rest alongside some of Philadelphia's great industrial tycoons. In the meantime, the Watsons held their own impromptu memorial service, going down to the mass grave one June afternoon to play the bagpipes.

Staff writer **ABIGAIL TUCKER** *reported on the excavation of a Virginia slave jail in the March 2009 issue.*

Around the Mall

SCENES AND SIGHTINGS FROM THE SMITHSONIAN MUSEUMS AND BEYOND

From the Castle p. 20
The Object at Hand p. 24
Q&A: Jane Lubchenco p. 25
What's Up p. 26

Michelle Delaney holds a portrait of 19th-century photography pioneer Levi Hill.

STEPHEN VOSS

CASE CLOSED?

A CURATOR AT THE NATIONAL MUSEUM OF AMERICAN HISTORY RESOLVES A 160-YEAR-OLD CONTROVERSY OVER A PIONEER IN COLOR PHOTOGRAPHY

PAGE 22

Bi-Centennial

BY G. WAYNE CLOUGH

IN 2010, WE CELEBRATE two seminal Smithsonian events—the opening of the largest museum ever built on the National Mall and the research that led to the founding of our tropical research institute in Panama.

One hundred years ago, in March 1910, the National Museum of Natural History (NMNH) first welcomed the public. Today with some 7.5 million annual visitors and over 30 million more online, NMNH is one of the world's most frequented museums. In a space equal to 18 football fields, NMNH staffers curate the world's largest natural history collection—126 million specimens—including 30 million insects, 4.5 million plants, 7 million fish and 2 million artifacts, drawings and photographs. Year after year millions of these specimens are on loan to researchers in nearly 100 countries.

Ushering NMNH into the 21st century are new exhibits and Web portals about the world's oceans and the science of human origins. The Encyclopedia of Life, in which NMNH is a lead partner, is creating a Web page for every known species. NMNH's global genome project is preserving DNA diversity. The museum's Recovering Voices program is documenting and sustaining endangered languages and traditional knowledge. And NMNH's deep time program is doing research and producing exhibits on environmental change over time—including the age of dinosaurs. With these and other initiatives, NMNH will continue to stand at the frontiers of science and encourage environmental stewardship.

NMNH, opened in 1910, is the largest museum on the Mall.

David McCullough, author of *The Path Between the Seas*, lists the Panama Canal among "humankind's greatest achievements." It increased global trade and led to advances in disease control, science and engineering. The first Smithsonian expeditions by NMNH and other scientists to Panama (1910-12) inaugurated 100 years of our research there. This work, which began with biodiversity surveys to meet the environmental challenges of building the canal, led to the founding of the Smithsonian Tropical Research Institute (STRI).

In 1923, Barro Colorado Island, located in the canal's Gatun Lake, became a biological preserve. With the agreement of Panama's government, it remains STRI's centerpiece. The island's 1,316 plant, 381 bird and 102 mammal species are some of the world's most studied. STRI's unique, pathbreaking Global Earth Observatories program assesses climate change's effects on the function and biodiversity of forest ecosystems by measuring the carbon dioxide that is absorbed from the atmosphere by millions of trees in 34 large-scale plots in 20 countries worldwide. The STRI centennial provides an opportunity to showcase its proud scientific past while recommitting the Smithsonian to provide an authoritative voice in today's debates about climate change and the impact of humans on biological diversity. These anniversaries are a good time for reflection as well as for charting bold courses to address global challenges—ensuring the Smithsonian's readiness for the next 100, even 1,000, years.

G. WAYNE CLOUGH *is Secretary of the Smithsonian Institution.*

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Hue and Cries

IN 1851, LEVI HILL CLAIMED HE INVENTED COLOR PHOTOGRAPHY. WAS HE A GENIUS OR A FRAUD?

"THERE, DO YOU SEE IT?" she asks, holding up a small, silvery rectangle in the half-lit room.

For a moment, I do: a splash of blue on a bird's wings. Then it disappears.

The photograph, captured some 160 years ago, reveals the outline of an owl and three smaller birds.

Lifting another plate from a storage box labeled "Hill, Levi," Michelle Delaney sighs as she examines it.

"Oh, that makes me sad. You used to be able to make out the outline of the village in the center here, but it's faded even more now," she says. I see only a blur of brown, gray and white; what a ghost might look like caught on camera.

In a sense, that's what Delaney, 44, curator of the National Museum of American History's photographic history collection, has been chasing the past three years: the ghost of the Rev. Levi L. Hill. In the years since his death in 1865, a few historians praised Hill as the unacknowledged inventor of color photography. (A Scotsman, James Clerk Maxwell, is generally credited with producing the first successful color photograph, in 1861.) Most, however, concluded that Hill was a hoodwinker.

Hill was a Baptist minister in West Kill, a tiny town in the foothills of New York's Catskill Mountains, when he began experimenting with daguerreotypes, an early form of photography. In February 1851, Hill made an astonishing claim: "I now have forty-five specimens, all of which present the several colors, true to a tint, and with a degree of brilliancy never seen in the richest Daguerreotype," he boasted in a letter to the *Daguerreian Journal*, the first commercially produced photography magazine. He vowed to continue experimenting until he "perfected the discovery" and assured fellow photographers that, after patenting the process, he would share it with all of them for a "reasonable" price.

The journal's editor, S. D. Humphery, lavished Hill with praise, christening his invention a "Hillotype." But the fervor soon soured. Hill had promised a public demonstration of his works and process, but he kept pushing the date back.

Hill had tried—and failed—to patent his method. An 1853 govern-

Lacking a patent, Hill (top) declined to explain his color process (above: two of his photographs). By the time he did so, most of his peers had concluded he was a charlatan.

ment document stated that "existing patent laws would not afford to the inventor the security required" for his chemical process. Hill turned his back on photography altogether in 1855 after his wife and research partner, Emmeline, died at age 38.

He did finally publish his ideas in an 1856 volume titled *A Treatise on Heliochromy*, but by then, says Delaney, most of his peers "had thoroughly dismissed Hill's work as fakery."

By the time he died nine years later, obituaries referred to his Hillotypes as a failed experiment.

"Hill had a lot of supporters and a lot of naysayers," says Delaney. Hoping to resolve the question of what Hill actually accomplished, she teamed up with independent conservator Corinne Dune and experts from the Getty Conservation Institute and George Eastman House. They analyzed the Smithsonian's collection of 62 Hillotypes, using the latest methods of spectroscopy to identify materials and pigments without damaging the works. What they found largely vindicated the inventive clergyman.

"There's limited color, but a wide enough range to see that he was successful," Delaney says. But the project's researchers also discovered that some of Hill's works had been hand-colored or enhanced.

Delaney, who is still researching Hill, plans to include a chapter about him in a book she is writing about early American photography. "I think his legacy is that he really inspired people, in both America and Europe, to go forth and work with color processes," she says.

She has made two visits to West Kill to consult local historians and archives, and hopes to track down more of Hill's work, since his logbooks show he was prolific. She is particularly curious about the contemporary European art prints Hill often used as photo subjects.

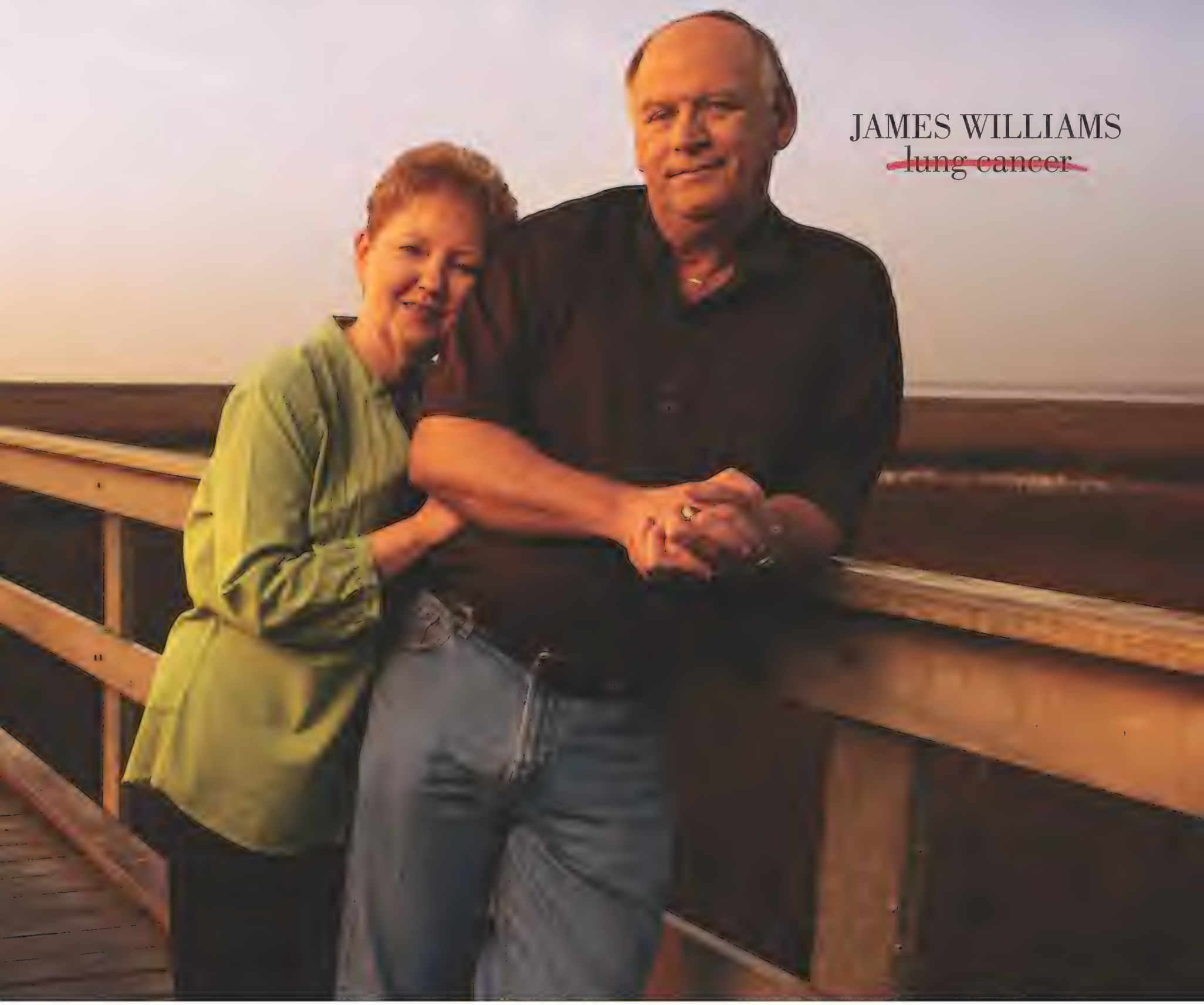
"West Kill is still basically a one-block town, so I'm thinking, where did he get all those European prints?" And, she wonders, "How would someone not trained in chemistry learn to do this stuff?"

At the very least, he was a colorful character. **AMANDA BENSEN**

NATIONAL MUSEUM OF AMERICAN HISTORY, SI (3)

See more about the history of color photography at Smithsonian.com/hillotype

"James didn't need a place that ONLY saw lung cancer a few times a year. I insisted on the ONE place with experts who treat cancer every single day."



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THE NATIONAL AIR AND SPACE MUSEUM • **MISSION CONTROL VEST**

Dressed for Success

Apollo 13 Flight Director Gene Kranz's homemade vest would become a fitting symbol **BY OWEN EDWARDS**

Kranz (in vest, as Apollo 13 safely splashed down) had faith that "as a group, we were smart enough . . . to get out of any problem."

FORTY YEARS AGO, for several unbearably tense days—April 13 to April 17, 1970—the whole world watched as NASA Flight Director Gene Kranz led a team that worked around the clock to rescue Apollo 13 astronauts Jim Lovell, Jack Swigert and Fred Haise. After an explosion of an oxygen tank partially crippled the moon-bound spacecraft, NASA's mission was to bring the trio safely back to Earth.

Today, Kranz's five-button, off-white vest (familiar to moviegoers who watched actor Ed Harris play Kranz in the film version of the crisis) holds pride of place at the Smithsonian National Air and Space Museum.

Kranz's wife, Marta, created the garment that would establish a Mission Control tradition. In 1962, when the Kranzes moved into a Houston neighborhood peopled by other space-program families, "all the wives sewed, and I began making vests for Gene," she recalls. "Gene wanted some kind of symbol for his team to rally around. I suggested a vest." The color, she adds, was not left to choice: "There were three Mission Control teams—red, white and blue—and Gene's was the white team, so his vests were always white." (Marta Kranz also made colorful vests for her husband to wear when celebrating splashdowns. At the successful conclusion of Apol-

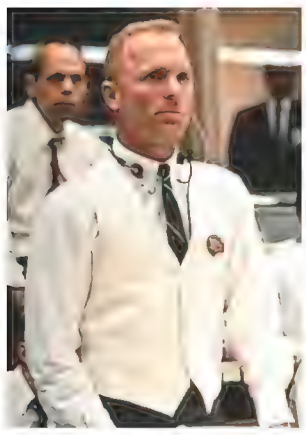
NASA / AP IMAGES; ERIC LONG / NASM, SI

Listen to the curator discuss Kranz's vest at Smithsonian.com/vest

lo 13, however, relief replaced celebration; the white vest stayed on.)

"I started wearing a vest during Gemini 4, and it was an immediate hit," Kranz recalls. "From then on, I put on a new vest on the first shift of every mission." Ultimately, according to NASM curator Margaret Weitekamp, Kranz's Apollo 13 vest would not only become a morale booster for his team, but also "a symbol for something much bigger than that"—the can-do spirit summed up in the title of Kranz's autobiography, *Failure Is Not an Option*.

For the 1995 movie, the studio was determined to fashion an exact replica. But the task turned out to be more complicated than *Apollo 13*'s costume designers anticipated. Marta Kranz had used faille, a fine-grained fabric of silk, satin or cotton, particularly popular during the 1950s. "When I told [the movie people] what it's made of," Marta recalls, "I don't think they knew what I was talking about." Soon, 29 swatches of sample fabrics arrived in her mail—but none were, so to speak, the right stuff. Then, she adds, "someone found off-white faille in a film warehouse."



Actor Ed Harris (as Gene Kranz) decreed: "Failure is not an option."

Kranz went on to serve as flight director for Apollo 17 (December 7-19, 1972), the final mission in the lunar landing series, then as deputy director and director of NASA mission operations. He retired from NASA in 1994. But that did not relieve Marta Kranz of her sartorial responsibilities. "I never had a chance to stop," she says. "Gene became a motivational speaker, and when he gave speeches, people wanted him to wear the white vest."

The only difference, she adds, laughing softly, "is that the configuration keeps changing."

OWEN EDWARDS *is a freelance writer and author of the book* Elegant Solutions.

Q&A

Marine ecologist **JANE LUBCHENCO**, administrator of the National Oceanic and Atmospheric Administration, spoke in March at the Natural History Museum on restoring the bounty of the world's oceans. The magazine's Erica R. Hendry caught up with her.

Has the way we view oceans changed?

Oh yes. We've truly begun to appreciate how vulnerable and valuable ocean ecosystems are. They're so vast, so immense, that people previously assumed they were infinitely bountiful and infinitely resilient.

We also now realize the full extent to which we depend upon oceans for our own well-being. Seafood is the sole or primary source of protein for more than a billion people worldwide. Half of Americans live in coastal areas. I've spoken with people all around the country, asking them, "What do you want from oceans, and what do you think we need from oceans?" Their answers boil down to: clean beaches, healthy seafood, abundant wildlife, vibrant coastal communities, stable fisheries, clean energy and good jobs.

And we've learned that ocean protection and restoration can work if they are implemented before an ecosystem is totally degraded.

You and your colleagues have discovered "dead zones" off the coasts of Oregon and Washington—where the oxygen content is so low that most marine life dies. Are these dead zones expanding or becoming more common?

Those dead zones have appeared regularly every summer since 2002, varying in size from one year to another. We believe they are caused by climate-related changes in coastal winds and the ocean. We don't know what the long-term consequences will be, though we've seen very vivid images of massive devastation on the seafloor. The key takeaway is that even an ecological system that seems very rich and very productive can be susceptible to catastrophic shifts in a relatively rapid period of time.

You've mentioned "holistic approaches." What do you mean by that?

The way we typically manage activity in the ocean—as well as on coasts—is sector by sector, issue by issue. One agency regulates water quality, another regulates fishing, another regulates energy extraction and another regulates shipping. We need a cohesive national policy, and a mechanism for integrating activities across the different branches of government.

The holistic approach also entails aligning conservation with economic incentives. New approaches—such as dividing up the total allowable catch among fishermen into shares—provide incentives to reduce wasteful practices that harm the environment and reduce profits. We all have a responsibility to protect and restore the oceans.

Read more of our interview with Jane Lubchenco at Smithsonian.com/lubchenco

THE HEINZ AWARDS; UNIVERSAL PICTURES / EVERETT COLLECTION

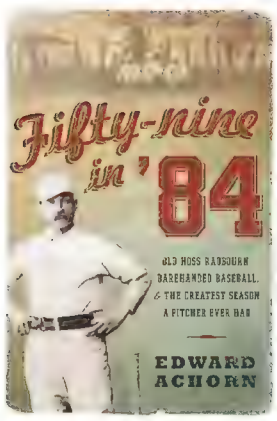
What's Up

GLASS FROM THE PAST

Explore nearly 175 years of European glassmaking through 162 rare Viennese works (left: *Cobalt Blue Series*, 1924-26) selected by guest curator Ted Muehling, a noted designer of jewelry and decorative arts. The show opens April 23 at the Cooper-Hewitt, in New York City.

OLD BALL GAME

Nineteenth-century baseball comes to life in *Fifty-Nine in '84* (Smithsonian Press, 2010), recounting pitcher Charles Radbourn's record 59 wins in a single season.



NOT FORGOTTEN

A permanent Portrait Gallery installation, "The Struggle for Justice," highlights cultural and political figures who fought for civil rights (above: *Rosa Parks*, painted limewood, 1983).

HIP TO BE SQUARE

Artist Josef Albers used geometric shapes to create optical illusions (below: *Homage to the Square: Glow*, 1966). See nearly 70 of his works at the Hirshhorn Museum through April 11.

SEEING BLUE

One of the world's most extraordinary gems, the 31.06-carat Wittelsbach-Graff Diamond, is on display—next to its rival, the 45.52-carat Hope Diamond—at the Natural History Museum through August 10.

BY ERICA R. HENDRY

VISIT THE SMITHSONIAN For a free Associates' planning packet, call 202 633-1000 or 202 357-1729 (TTY), 9 a.m. to 5 p.m. Monday through Friday and 9 a.m. to 4 p.m. Saturday. Or send an e-mail to info@si.edu. The Smithsonian Information Center in the Castle is open daily, 8:30 a.m. to 5:30 p.m. Members can visit the reception desk between 9 a.m. and 4 p.m. to register for a behind-the-scenes tour and to hear about membership benefits. Most museums are open daily, 10 a.m. to 5:30 p.m. All museums are closed December 25.

Get an insider's look at the Smithsonian at Smithsonian.com/mallblog

ANDREW GARN / COOPER-HEWITT DESIGN MUSEUM, SI; MARSHALL D. RUMBAUGH / NPG, SI; CHIP CLARK / NMNH, SI; SI BOOKS; HIRSHHORN MUSEUM, SI

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THIS MONTH IN HISTORY

APRIL ANNIVERSARIES
MOMENTOUS OR MERELY MEMORABLE

BY ALISON McLEAN

20 YEARS AGO
BANG-UP JOB

The Hubble Space Telescope is deployed 353 miles above Earth on April 25, 1990. After a 1993 mission corrects its vision, the school bus-size telescope's images—including galaxies in all stages, protoplanetary disks and stellar nurseries (above: Eagle Nebula)—alter our understanding of the nature of the universe.

75 YEARS AGO
DUST TO DUST

April 14, 1935, dawns clear, but by afternoon the worst dust storm of the "dirty Thirties" strikes across the Great Plains. "It rolled, it didn't just dust," Arthur Leonard of Dodge City, Kansas, will later remember. "It was coal black and it was terrible." The result of prolonged drought and the removal of erosion-stopping sod from the prairies by over-plowing, "Black Sunday" removes an estimated 300,000 tons of topsoil from the area afterward known as the Dust Bowl. By 1940, dust storm devastation will force hundreds of thousands of people to relocate.

110 YEARS AGO COME ALL YOU ROUNDERS

Illinois Central Railroad engineer John Luther "Casey" Jones, 37, making up for lost time on the Canton, Mississippi-bound "New Orleans Special" on the foggy morning of April 30, 1900, rounds a turn to see freight cars in his path. As his fireman jumps to safety, Jones goes into reverse and pulls the air brakes, but his engine slams through the freight train's caboose before stopping. Though the railroad will blame the wreck on Jones, his dying actions save all his passengers, and he rides into folk legend through the many versions of "The Ballad of Casey Jones."

40 YEARS AGO GETTING DOWN TO EARTH

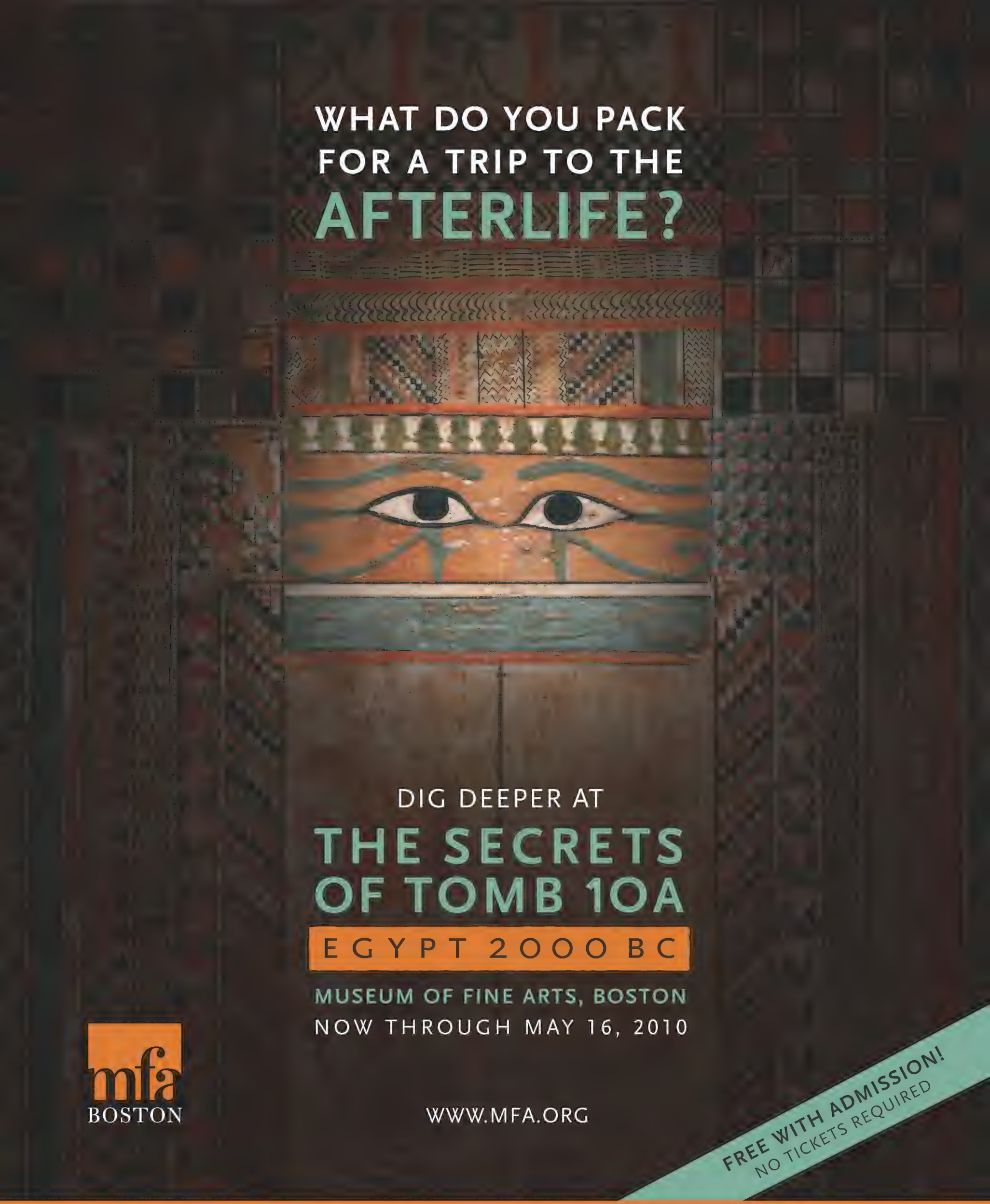
In an effort to put ecological issues on the national political agenda, Senator Gaylord Nelson of Wisconsin founds Earth Day, April 22, 1970, as a national "teach-in" on environmental degradation. Taking a page from campus antiwar demonstrations, organizers across the country stage grass-roots events—cars are banned on much of New York City's Fifth Avenue; children ride horses down highways in Takoma, Washington—that draw an estimated 20 million people. By year's end the Environmental Protection Agency has opened in Washington, D.C. Gaylord Nelson dies in 2005.

150 YEARS AGO POSTHASTE

At the sound of a cannon in St. Joseph, Missouri, a bay mare and her rider race toward San Francisco, 1,800 miles away, in the April 3, 1860, inaugural run of the Pony Express. The 49 letters and 5 telegrams the pair carry will reach California 11 days and some 75 horses and 20 riders later, 10 days faster than stagecoach times. For 18 months the Express fights weather, wild terrain, Indians and robbers to speed mail to settlers lured west by land, gold and religious freedom, losing only one shipment. It yields to the telegraph, which links East Coast to West in October 1861.

Visit Smithsonian.com/history for "Today in History"

DUST STORM AT STRATFORD, TX./ DI_03274 / THE DOLPH BRISCOE CENTER FOR AMERICAN HISTORY / THE UNIVERSITY OF TEXAS AT AUSTIN; NASA, ESA, AND THE HUBBLE HERITAGE TEAM (STSCI/AURA); CASEY JONES MUSEUM; HULTON ARCHIVE / GETTY IMAGES; PETER NEWARK WESTERN AMERICANA / BRIDGEMAN ART LIBRARY INTERNATIONAL



The exhibition is supported by
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Major funding is provided by
The Calderwood Charitable Foundation.

Additional support for the
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Above: Front side panel of outer coffin of Djehutynakht (detail), Egyptian, Middle Kingdom, late Dynasty 11–early Dynasty 12, 2010–1961 BC. Cedar. Harvard University–Boston Museum of Fine Arts Expedition.

SOUTH POLE DISPATCH

PROBING THE BIGGEST MYSTERY IN THE UNIVERSE

Smithsonian
APRIL 2010 · VOLUME 41, NUMBER 1

Astronomers are going to the ends of the Earth to study **"dark energy,"** a force greater than gravity that will determine the fate of the cosmos

BY RICHARD PANEK

Far from extraneous light and plunged into months-long darkness, Antarctica's South Pole Telescope (against the glow of the aurora australis, or southern lights) is one of the best places on Earth for observing the rest of the universe. (Red light helps astronomers maintain night vision.)

TWICE A DAY, SEVEN DAYS A WEEK, from February to November for the past four years, two researchers have layered themselves with thermal underwear and outerwear, with fleece, flannel, double gloves, double socks, padded overalls and puffy red parkas, mummifying themselves until they look like twin Michelin Men. Then they step outside, trading the warmth and modern conveniences of a science station (foosball, fitness center, 24-hour cafeteria) for a minus-100-degree Fahrenheit featureless landscape, flatter than Kansas and one of the coldest places on the planet. They trudge in darkness nearly a mile, across a plateau of snow and ice, until they discern, against the backdrop of more stars than any hands-in-pocket backyard observer has ever seen, the silhouette of the giant disk of the South Pole Telescope, where they join a global effort to solve possibly the greatest riddle in the universe: what most of it is made of.

For thousands of years our species has studied the night sky and wondered if anything else is out there. Last year we celebrated the 400th anniversary of Galileo's answer: Yes. Galileo trained a new instrument, the telescope, on the heavens and saw objects that no other person had ever seen: hundreds of stars, mountains on the Moon, satellites of Jupiter. Since then we have found more than 400 planets around other stars, 100 billion stars in our galaxy, hundreds of billions of galaxies beyond our own, even the faint radiation that is the echo of the Big Bang.

Now scientists think that even this extravagant census of the universe might be as out-of-date as the five-planet cosmos that Galileo inherited from the ancients. Astronomers have compiled evidence that what we've always thought of as the actual universe—me, you, this magazine,

planets, stars, galaxies, all the matter in space—represents a mere 4 percent of what's actually out there. The rest they call, for want of a better word, dark: 23 percent is something they call dark matter, and 73 percent is something even more mysterious, which they call dark energy.

"We have a complete inventory of the universe," Sean Carroll, a California Institute of Technology cosmologist, has said, "and it makes no sense."

Scientists have some ideas about what dark matter might be—exotic and still hypothetical particles—but they have hardly a clue about dark energy. In 2003, the National Research Council listed "What Is the Nature of Dark Energy?" as one of the most pressing scientific problems of the coming decades. The head of the committee that wrote the report, University of Chicago cosmologist Michael S. Turner, goes further and ranks dark energy as "the most profound mystery in all of science."

The effort to solve it has mobilized a generation of astronomers in a rethinking of physics and cosmology to rival and perhaps surpass the revolution Galileo inaugurated on an autumn evening in Padua. They are coming to terms with a deep irony: it is sight itself that has blinded us to nearly the entire universe. And the recognition of this blindness, in turn, has inspired us to ask, as if for the first time: What is this cosmos we call home?

SCIENTISTS REACHED A CONSENSUS in the 1970s that there was more to the universe than meets the eye. In computer simulations of our galaxy, the Milky Way, theorists found that the center would not hold—based on what we can see of it, our galaxy doesn't have enough mass to keep everything in place. As it rotates, it should disintegrate, shedding stars and gas in every direction. Either a spiral galaxy such as the Milky Way violates the laws of gravity, or the light emanating from it—from the vast glowing clouds of gas and the myriad stars—is an inaccurate indication of the galaxy's mass.

But what if some portion of a galaxy's mass didn't radiate light? If spiral galaxies contained enough of such mystery mass, then they might well be obeying the laws of gravity. Astronomers dubbed the invisible mass "dark matter."

"Nobody ever told us that all matter radiated," Vera Rubin, an astronomer whose observations of galaxy rotations provided evidence for dark matter, has said. "We just assumed that it did."

IT'S "THE MOST PROFOUND MYSTERY IN ALL OF SCIENCE."

Michael Turner (below) coined the term "dark energy" in 1998. No one knows what it is.

The effort to understand dark matter defined much of astronomy for the next two decades. Astronomers may not know what dark matter is, but inferring its presence allowed them to pursue in a new way an eternal question: What is the fate of the universe?

They already knew that the universe is expanding. In 1929, the astronomer Edwin Hubble had discovered that distant galaxies were moving away from us and that the farther away they got, the faster they seemed to be receding.

This was a radical idea. Instead of the stately, eternally unchanging still life that the universe once appeared to be, it was actually alive in time, like a movie. Rewind the film of the expansion and the universe would eventually reach a state of infinite density and energy—what astronomers call the Big Bang. But what if you hit fast-forward? How would the story end?

The universe is full of matter, and matter attracts other matter through gravity. Astronomers reasoned that the mutual attraction among all that matter must be slowing down the expansion of the universe. But they didn't know what the ultimate outcome would be. Would the gravitational effect be so forceful that the universe would ultimately stretch a certain distance, stop and reverse itself, like a ball tossed into the air? Or would it be so slight that the universe would escape its grasp and never stop expanding, like a rocket leaving Earth's atmosphere? Or did we live in an exquisitely balanced universe, in which gravity ensures a Goldilocks rate of expansion neither too fast nor too slow—so the universe would eventually come to a virtual standstill?

Assuming the existence of dark matter and that the law of gravitation is universal, two teams of astrophysicists—one led by Saul Perlmutter, at the Lawrence Berkeley National Laboratory, the other by Brian Schmidt, at Australian National University—set out to determine the future of the universe. Throughout the 1990s the rival teams closely analyzed a number of exploding stars, or supernovas, using those unusually bright, short-lived distant objects to gauge the universe's growth. They knew how bright the supernovas *should* appear at different points across the universe if the rate of expansion were uniform. By comparing how much brighter the supernovas actually *did* appear, astronomers figured they could determine how much the expansion of the universe was slowing down. But to the astronomers' surprise, when they looked as far as halfway across the universe, six or seven billion light-years away, they found that the supernovas weren't brighter—and therefore nearer—than expected. They

RICHARD PANEK *wrote about Einstein for* SMITHSONIAN *in 2005. His book on dark matter and dark energy will appear in 2011.*

COURTESY OF MICHAEL TURNER; PP. 30-31 KEITH VANDERLINDE / NATIONAL SCIENCE FOUNDATION

Scientists working at the South Pole (below left: engineer Dana Hrubes adjusts a battery) stay in a facility resting on stilts that are raised as snow accumulates (above: the base station and flag-marked path to the observatories). With no aircraft flights during the darkest half of the year, researchers fend for themselves (below right: growing fresh vegetables under artificial light).

KEITH VANDERLINDE / NATIONAL SCIENCE FOUNDATION; CALEE ALLEN / NATIONAL SCIENCE FOUNDATION; BRIEN BARNETT / NATIONAL SCIENCE FOUNDATION

were dimmer—that is, more distant. The two teams both concluded that the expansion of the universe isn't slowing down. It's speeding up.

The implication of that discovery was momentous: it meant that the dominant force in the evolution of the universe isn't gravity. It is . . . something else. Both teams announced their findings in 1998. Turner gave the "something" a nickname: dark energy. It stuck. Since then, astronomers have pursued the mystery of dark energy to the ends of the Earth—literally.

"THE SOUTH POLE HAS the harshest environment on Earth, but also the most benign," says William Holzapfel, a University of California at Berkeley astrophysicist who was the on-site lead researcher at the South Pole Telescope (SPT) when I visited.

He wasn't referring to the weather, though in the week between Christmas and New Year's Day—early summer in the Southern Hemisphere—the Sun shone around the clock, the temperatures were barely in the minus single digits (and one day even broke zero), and the wind was mostly calm. Holzapfel made the walk from the National Science Foundation's Amundsen-Scott South Pole Station (a snowball's throw from the traditional site of the pole itself, which is marked with, yes, a pole) to the telescope wearing jeans and running shoes. One afternoon the telescope's laboratory building got so warm the crew propped open a door.

But from an astronomer's perspective, not until the Sun

goes down and stays down—March through September—does the South Pole get "benign."

"It's six months of uninterrupted data," says Holzapfel. During the 24-hour darkness of the austral autumn and winter, the telescope operates nonstop under impeccable conditions for astronomy. The atmosphere is thin (the pole is more than 9,300 feet above sea level, 9,000 of which are ice). The atmosphere is also stable, due to the absence of the heating and cooling effects of a rising and setting Sun; the pole has some of the calmest winds on Earth, and they almost always blow from the same direction.

Perhaps most important for the telescope, the air is exceptionally dry; technically, Antarctica is a desert. (Chapped hands can take weeks to heal, and perspiration isn't really a hygiene issue, so the restriction to two showers a week to conserve water isn't much of a problem. As one pole veteran told me, "The moment you go back through customs at Christchurch [New Zealand], that's when you'll need a shower.") The SPT detects microwaves, a part of the electromagnetic spectrum that is particularly sensitive to water vapor. Humid air can absorb microwaves and prevent them from reaching the telescope, and moisture emits its own radiation, which could be misread as cosmic signals.

To minimize these problems, astronomers who analyze microwaves and submillimeter waves have made the South Pole a second home. Their instruments reside in the Dark Sector, a tight cluster of buildings where light and other sources of electromagnetic radiation are kept to a minimum. (Nearby are the Quiet Sector, for seismology research, and the Clean Air Sector, for climate projects.)

Astronomers like to say that for more pristine observing conditions, they would have to go into outer space—an exponentially more expensive proposition, and one that NASA generally doesn't like to pursue unless the science can't easily be done on Earth. (A dark energy satellite has been on and off the drawing board since 1999, and last year went "back to square one," according to one NASA adviser.) At least on Earth, if something goes wrong with an instrument, you don't need to commandeer a space shuttle to fix it.

The United States has maintained a year-round presence at the pole since 1956, and by now the National Science Foundation's U.S. Antarctic Program has gotten life there down to, well, a science. Until 2008, the station was housed in a geodesic dome whose crown is still visible above the snow. The new base station resembles a small cruise ship more than a remote outpost and sleeps more than 150, all in private quarters. Through the portholes that line the two floors, you can contemplate a horizon as hypnotically level as any ocean's. The new station rests on lifts that, as snow accumulates, allow it to be jacked up two full stories.

The snowfall in this ultra-arid region may be minimal, but that which blows in from the continent's edges can still make a mess, creating one of the more mundane tasks for the SPT's winter-over crew. Once a week during the dark months, when the station population shrinks to around 50, the two on-site SPT researchers have to climb into the telescope's 33-foot-wide microwave dish and sweep it clean. The telescope gathers data and sends it to the desktops of distant researchers. The two "winter-overs" spend their days working on the data, too, analyzing it as if they were back home. But when the telescope hits a glitch and an alarm on their laptops sounds, they have to figure out what the problem is—fast.

GALAXY CLUSTERS "ARE SORT OF LIKE CANARIES IN A COAL MINE."

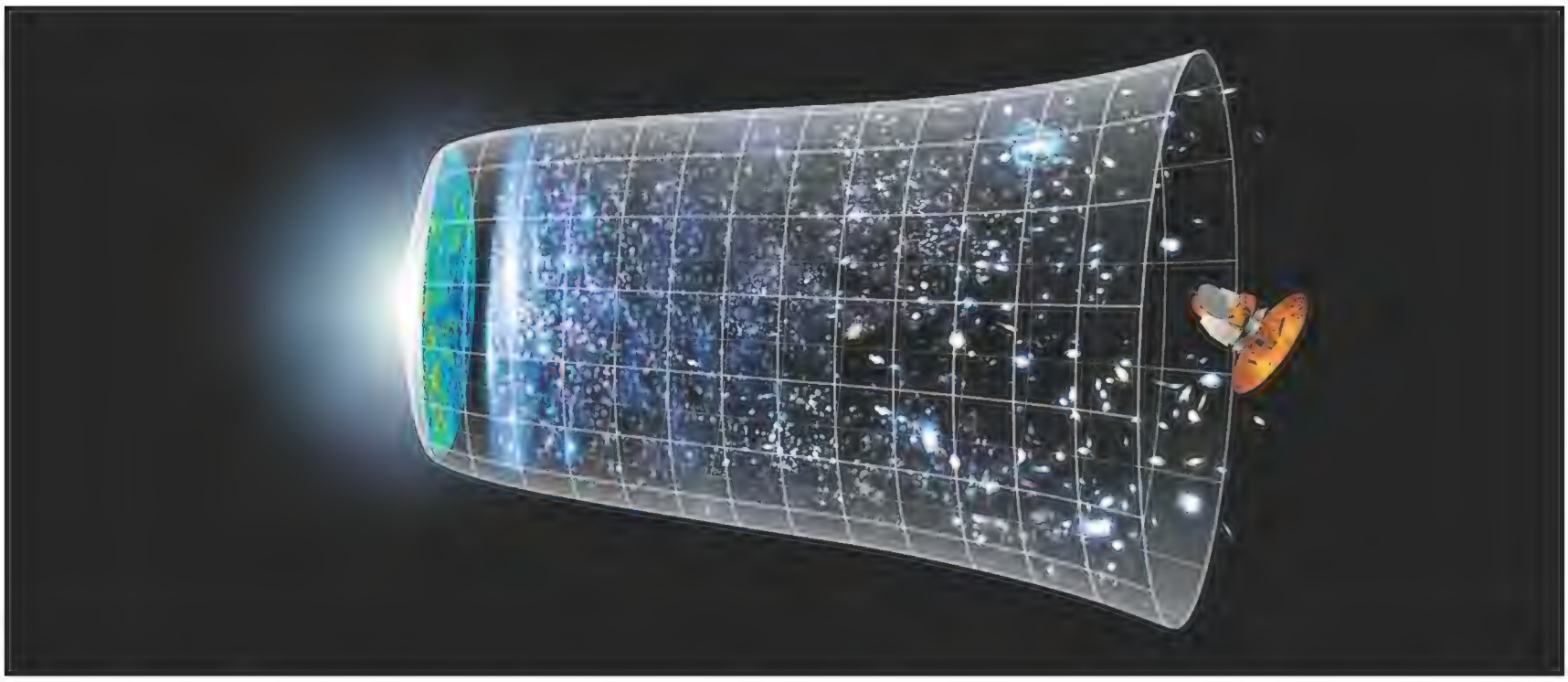
William Holzapfel (at the South Pole Telescope) studies dark energy's impact on galaxies.

"An hour of down time is thousands of dollars of lost observing time," says Keith Vanderlinde, one of 2008's two winter-overs. "There are always little things. A fan will break because it's so dry down there, all the lubrication goes away. And then the computer will overheat and turn itself off, and suddenly we're down and we have no idea why." At that point, the environment might not seem so "benign" after all. No flights go to or from the South Pole from March to October (a plane's engine oil would gelatinize), so if the winter-overs can't fix whatever is broken, it stays broken—which hasn't yet happened.

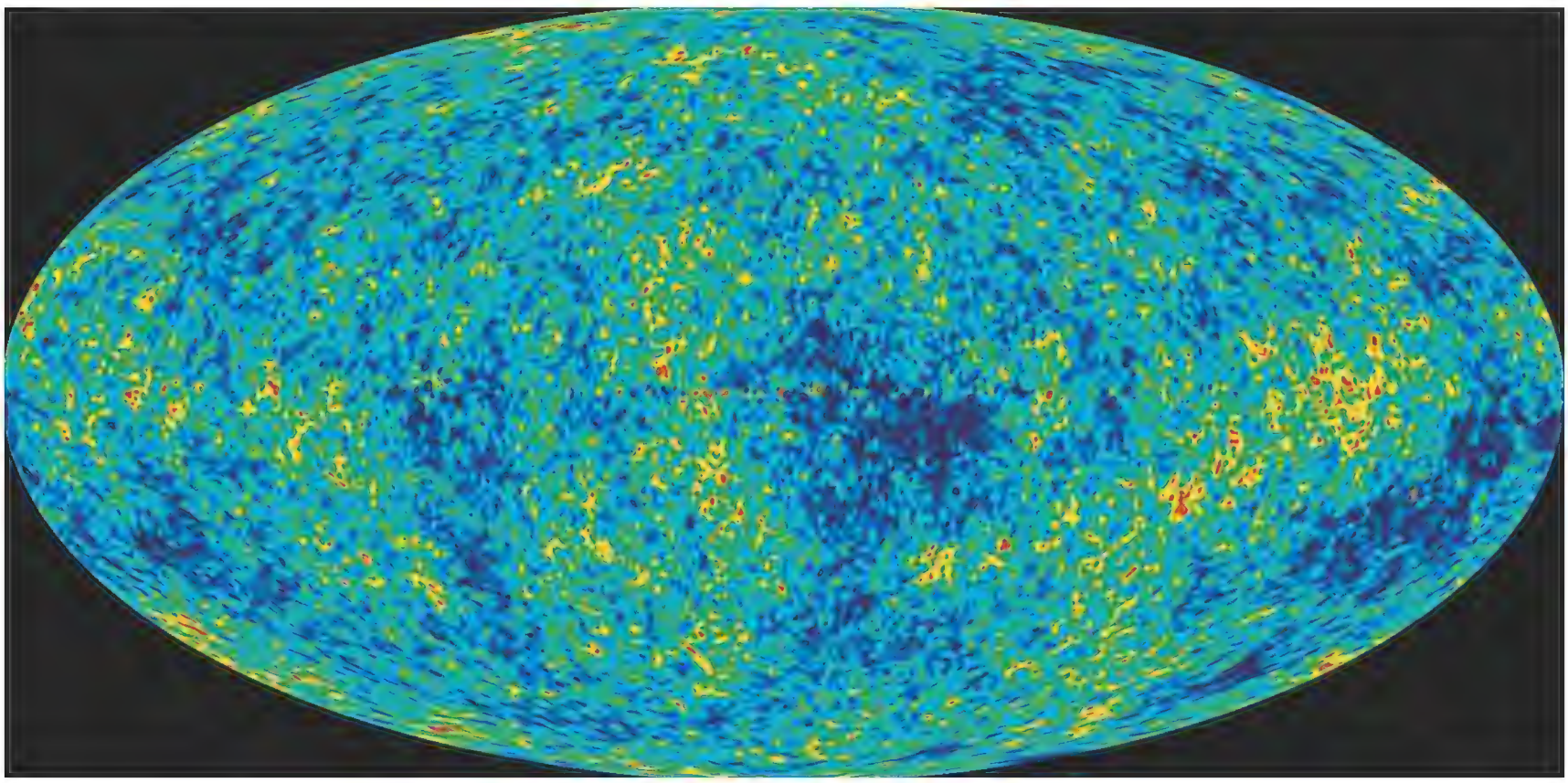
MORE THAN MOST SCIENCES, astronomy depends on the sense of sight; before astronomers can reimagine the universe as a whole, they first have to figure out how to perceive the dark parts. Knowing what dark matter is would help scientists think about how the structure of the universe forms. Knowing what dark energy does would help scientists think about how that structure has evolved over time—and how it will continue to evolve.

Scientists have a couple of candidates for the composition of dark matter—hypothetical particles called neutralinos and axions. For dark energy, however, the challenge is to figure out not what it is but what it's like. In particular, astronomers want to know if dark energy changes over space and time, or whether it's constant. One way to study it is to measure so-called baryon acoustic oscillations. When the universe was still in its infancy, a mere 379,000 years old, it cooled sufficiently for baryons (particles made from protons and neutrons) to separate from photons (packets of light). This separation left behind an imprint—

BRAD BENSON



Above: To put it in a nutshell, the universe began with the Big Bang nearly 14 billion years ago (above, at left), rapidly inflated and is still expanding today (at right). Rather than slowing down, scientists say, the expansion has been speeding up, driven by dark energy. Below: A map of hot spots across the infant universe shows where matter later concentrated and gave rise to galaxies.



NASA / WMAP SCIENCE TEAM (2)

called the cosmic microwave background—that can still be detected today. It includes sound waves ("acoustic oscillations") that coursed through the infant universe. The peaks of those oscillations represent regions that were slightly denser than the rest of the universe. And because matter attracts matter through gravity, those regions grew even denser as the universe aged, coalescing first into galaxies and then into clusters of galaxies. If astronomers compare the original cosmic microwave background oscillations with the distribution of galaxies at different stages of the universe's history, they can measure the rate of the universe's expansion.

Another approach to defining dark energy involves a method called gravitational lensing. According to Albert Einstein's theory of general relativity, a beam of light traveling through space appears to bend because of the gravitational pull of matter. (Actually, it's space itself that bends, and light just goes along for the ride.) If two clusters of galaxies lie along a single line of sight, the foreground cluster will act as a lens that distorts light coming from the background cluster. This distortion can tell astronomers the mass of the foreground cluster. By sampling millions of galaxies in different parts of the universe, astronomers should be able to estimate the rate at which galaxies have clumped into clusters over time, and that rate in turn will tell them how fast the universe expanded at different points in its history.

The South Pole Telescope uses a third technique, called the Sunyaev-Zel'dovich effect, named for two Soviet physicists,

which draws on the cosmic microwave background. If a photon from the latter interacts with hot gas in a cluster, it experiences a slight increase in energy. Detecting this energy allows astronomers to map those clusters and measure the influence of dark energy on their growth throughout the history of the universe. That, at least, is the hope. "A lot of people in the community have developed what I think is a healthy skepticism. They say, 'That's great, but show us the money,'" says Holzapfel. "And I think within a year or two, we'll be in a position to be able to do that."

The SPT team focuses on galaxy clusters because they are the largest structures in the universe, often consisting of hundreds of galaxies—they are one million billion times the mass of the Sun. As dark energy pushes the universe to expand, galaxy clusters will have a harder time growing. They will become more distant from one another, and the universe will become colder and lonelier.

Galaxy clusters "are sort of like canaries in a coal mine in terms of structure formation," Holzapfel says. If the density of dark matter or the properties of dark energy were to change, the abundance of clusters "would be the first thing to be altered." The South Pole Telescope should be able to track galaxy clusters over time. "You can say, 'At so many billion years ago, how many clusters were there, and how many are there now?'" says Holzapfel. "And then compare them to your predictions."

Yet all these methods come with a caveat. They assume that we sufficiently understand gravity, which is not only the force opposing dark energy but has been the very foundation of physics for the past four centuries.

FOR THE EARTH AND THE MOON, "SO FAR, EINSTEIN IS HOLDING."

Astronomers (below: Russet McMillan) use gravity in their hunt for dark energy.

TWENTY TIMES A SECOND, a laser high in the Sacramento Mountains of New Mexico aims a pulse of light at the Moon, 239,000 miles away. The beam's target is one of three suitcase-size reflectors that Apollo astronauts planted on the lunar surface four decades ago. Photons from the beam bounce off the mirror and return to New Mexico. Total round-trip travel time: 2.5 seconds, more or less.

That "more or less" makes all the difference. By timing the speed-of-light journey, researchers at the Apache Point Observatory Lunar Laser-ranging Operation (APOLLO) can measure the Earth-Moon distance moment to moment and map the Moon's orbit with exquisite precision. As in the apocryphal story of Galileo dropping balls from the Leaning Tower of Pisa to test the universality of free fall, APOLLO treats the Earth and Moon like two balls dropping in the gravitational field of the Sun. Mario Livio, an astrophysicist at the Space Telescope Science Institute in Baltimore, calls it an "absolutely incredible experiment." If the orbit of the Moon exhibits even the slightest deviation from Einstein's predictions, scientists might have to rethink his equations—and perhaps even the existence of dark matter and dark energy.

"So far, Einstein is holding," says one of APOLLO's lead observers, astronomer Russet McMillan, as her five-year project passes the halfway point.

Even if Einstein weren't holding, researchers would first have to eliminate other possibilities, such as an error in the measure of the mass of the Earth, Moon or Sun, before conceding that general relativity requires a corrective. Even so, astronomers know that they take gravity for granted at their own peril. They have inferred the existence of dark matter due to its gravitational effects on galaxies, and the existence of dark energy due to its anti-gravitational effects on the expansion of the universe. What if the assumption underlying these twin inferences—that we know how gravity works—is wrong? Can a theory of the universe even more outlandish than one positing dark matter and dark energy account for the evidence? To find out, scientists are testing gravity not only across the universe but across the tabletop. Until recently, physicists hadn't measured gravity at extremely close ranges.

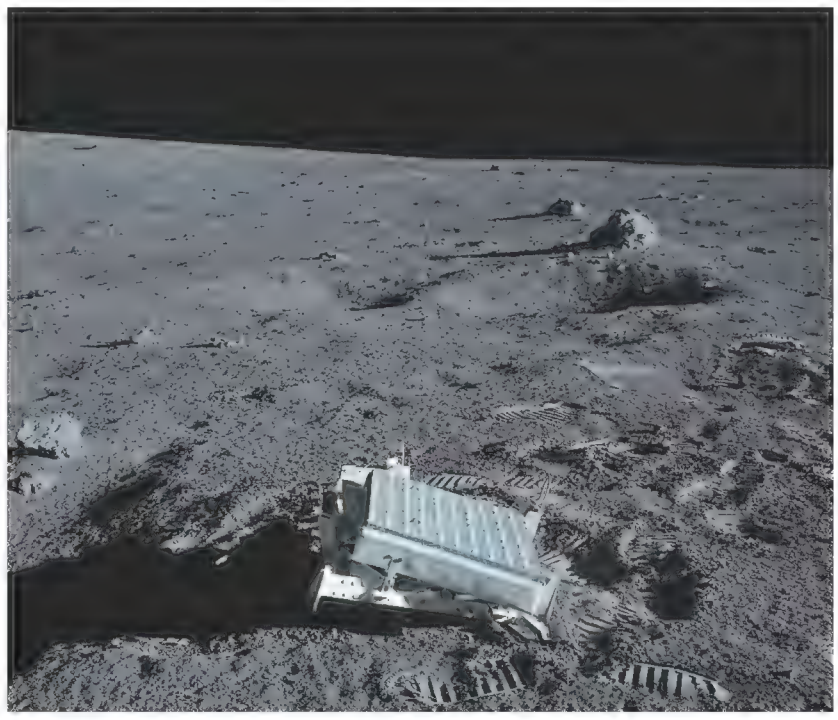
"Astonishing, isn't it?" says Eric Adelberger, the coordinator of several gravity experiments taking place in a laboratory at the University of Washington, Seattle. "But it wouldn't be astonishing if you tried to do it"—if you tried to test gravity at distances shorter than a millimeter. Testing gravity isn't simply a matter of putting two objects close to each other and measuring the attraction between them. All sorts of other things may be exerting a gravitational influence.

"There's metal here," Adelberger says, pointing to a nearby instrument. "There's a hillside over here"—waving toward some point past the concrete wall that encircles the laboratory. "There's a lake over there." There's also the groundwater level in the soil, which changes every time it rains. Then there's the rotation of the Earth, the position of the Sun, the dark matter at the heart of our galaxy.

Over the past decade the Seattle team has measured the gravitational attraction between two objects at smaller and smaller distances, down to 56 microns (or 1/500 of an inch), just to make sure that Einstein's equations for gravity hold true at the shortest distances, too. So far, they do.

But even Einstein recognized that his theory of general relativity didn't entirely explain the universe. He spent the last 30 years of his life trying to reconcile his physics

GRETCHEN VAN DOREN



Scientists at the Apache Point Observatory in New Mexico (above) repeatedly aim a laser beam at the Moon (below left) and time the light's return to Earth, giving them the Moon's distance to within a millimeter. This measure of the gravitational pull between the Earth and Moon (below right: a reflector placed by an astronaut in 1969) helps astronomers define dark energy.

GRETCHEN VAN DOREN / ASTROPHYSICAL RESEARCH CONSORTIUM; TOM MURPHY; NASA

of the very big with the physics of the very small—quantum mechanics. He failed.

Theorists have come up with all sorts of possibilities in an attempt to reconcile general relativity with quantum mechanics: parallel universes, colliding universes, bubble universes, universes with extra dimensions, universes that eternally reproduce, universes that bounce from Big Bang to Big Crunch to Big Bang.

Adam Riess, an astronomer who collaborated with Brian Schmidt on the discovery of dark energy, says he looks every day at an Internet site (xxx.lanl.gov/archive/astro-ph) where scientists post their analyses to see what new ideas are out there. "Most of them are pretty kooky," he says. "But it's possible that somebody will come out with a deep theory."

For all its advances, astronomy turns out to have been laboring under an incorrect, if reasonable, assumption: what you see is what you get. Now astronomers have to adapt to the idea that the universe is not the stuff of us—in the grand scheme of things, our species and our planet and our galaxy and everything we have ever seen are, as theoretical physicist Lawrence Krauss of Arizona State University has said, "a bit of pollution."

Yet cosmologists tend not to be discouraged. "The really hard problems are great," says Michael Turner, "because we know they'll require a crazy new idea." As Andreas Albrecht, a cosmologist at the University of California at Davis, said at a recent conference on dark energy: "If you put the timeline of the history of science before me and I could choose any time and field, this is where I'd want to be."

ALL-AMERICAN MONSTERS

Long before dinosaurs were discovered, mammoths and mastodons gave the young United States a symbol of national might BY RICHARD CONNIFF

IN THE BLUE SHADOWS AFTER DAWN, THE low hills in this stretch of South Dakota can look like a line of elephants trudging toward some distant water hole. It's a geologic echo of the great herds of Columbian mammoths that used to wander here. They were like African elephants, only bigger. "A full-grown adult weighed ten tons. That's as much as a school bus," a guide tells the tourists on a sidewalk at the Mammoth Site, a paleontological dig and museum in the town of Hot Springs. She points out a set of brick-size teeth with corrugated surfaces like the soles of running shoes. With them, a mammoth ate 400 pounds of grasses and sedges a day.

Directly below the sidewalk, a volunteer scratches up dirt in a niche formed largely by the bones of dead mammoths. She's got a big shoulder blade sticking up out of the ground off her knees, the round end of a leg bone at her right elbow, ribs like stripes painted in the dirt wall just above, and behind her a sort of cascade of half-excavated skulls and tusks spilling down to the bottom of the dig. Altogether, parts of 58 mammoths lie exposed in an area about the size of a hockey rink, sheltered beneath a roof built to protect them. Larry Agenbroad, the paleontologist who helped discover this site 35 years ago, figures at least as many remain hidden underground.

This is one of the world's largest sites that display the bones where mammoths died, and it has some of the horror and fascination of a slow-motion traffic pileup. About 26,000 years ago, Agenbroad says, a sinkhole formed here and filled with water from a hot spring, creating a vegetated oasis that lured many young mammoths to their death. In places, the bones have settled in the posture of the animal's desperate struggle to get back up the slick, steep sides of the pond, a foreleg flung up, the back legs splayed out where they pawed for traction in the mud below.

Columbian mammoths (opposite) were larger than mastodons (below). Both once roamed North America.

Occasionally a visitor will imagine the fear and trumpeting of the struggling animal and start to weep.

The guides, volunteers and paleontologists at the Mammoth Site are a bit more jaded. They've nicknamed one disarticulated skeleton Napoleon Bone-Apart. Another specimen, found minus its skull, started out as Marie Antoinette, after the guillotined French queen. It turned out to be a male, like all the other mammoths in this site. "So we renamed it Murray," says Agenbroad, a soft-spoken, neighborly figure with bright, deep-set eyes behind rimless glasses.

It's a venerable American tradition, this mix of science, show business and big hairy pachyderms. The same happy combination drives a new exhibition, "Mammoths and Mastodons: Titans of the Ice Age," which just opened at Chicago's Field Museum (and travels to Jersey City, Anchorage, St. Louis, Boston, Denver and San Diego). With Agenbroad as a consultant, one part of the exhibition aims to evoke the world of the mammoths in the South Dakota hills. Other parts explore the profound influence these creatures had in human history. Though dinosaurs now come to mind when we think about lost worlds, mammoths and mastodons provided the first persuasive evidence that one of God's creatures could go extinct. (The idea had previously bordered on heresy, but we now know that the animals vanished mysteriously roughly 11,000 years ago.) And though we often associate them with Siberia, mammoths and mastodons played a huge role in establishing our national identity, as Americans struggled to climb out from under the shadow of Europe.

IT STARTED WITH A FIVE-POUND TOOTH. In the summer of 1705, in the Hudson River Valley village of Claverack, New York, a tooth the size of a man's fist surfaced on a steep bluff, rolled downhill and landed at the feet of a Dutch tenant farmer, who promptly traded it to a local politician for a glass of rum. The politician made the tooth a gift to Lord Cornbury, then the eccentric governor of New York. (Cornbury liked to cross-dress as his cousin Queen Anne, or so his enemies said.) Cornbury sent the tooth to London labeled "tooth of a Giant," after the statement in Genesis that "there were giants in the earth" in the days before the Flood.

Man or beast, this "monstrous creature," as Cornbury called it, would soon become celebrated as the "*incognitum*," the unknown species. The discovery of dinosaurs was more than a century in the future, but in terms of this creature's grip on the popular imagination, it was "the dinosaur of the early American republic," according to Paul Semonin, author of *American Monster*, a history of the *incognitum*. Some primal force in the American spirit embraced it, he says, as "in effect, the nation's first prehistoric monster."

Based on the size of bones discovered near the tooth, the Massachusetts poet Edward Taylor estimated the *incognitum*'s height at 60 or 70 feet (10 would have been closer to the mark) and wrote bad poetry about "Ribbs like Rafters" and arms "like limbs of trees." The minister Cotton Mather boasted that the New World possessed biblical giants to make the Old World's "Og and GOLIATH, and all the Sons of *Anak*" look like pygmies.

When similar teeth later turned up in South Carolina, slaves pointed out that they looked a lot like an African elephant's.

PP. 40-41 (TOP) BLAKE GORDON / AURORA SELECT; PP. 38-39 VELIZAR SIMEONOVSKI / THE FIELD MUSEUM, CHICAGO (2)

MAP: GUILBERT GATES; PP. 40-41 (BOTTOM ROW) MAMMOTH SITE OF HOT SPRINGS, SD.; BLAKE GORDON / AURORA SELECT (2)

MAMMOTH & MASTODON

Where They Wandered

Columbian mammoths predominated in the open grasslands of the West, mastodons in the forests of the East. The map below shows sites where the two animals' fossilized remains have been found.

The Mammoth Site in Hot Springs, South Dakota (above left), preserves the fossilized remains of Columbian mammoths at the place where warm waters and foliage lured them to their deaths 26,000 years ago. "They never look the same on a shelf," says paleontologist Larry Agenbroad (below far left). Volunteer Ruth Clemmer (below middle) exposes a bone, part of an effort to add to the 58 specimens that have been brought to light (below right).

Early explorers also brought back whole tusks and bones from the Ohio River Valley. Americans soon started referring to the *incognitum* as a "mammoth," after the woolly mammoths then being dug out of the ice in Siberia. It fact, it would turn out that North America had been home primarily to two different types of pachyderm—mammoths, like the ones at the dig in South Dakota, and mastodons, like the ones in the Hudson River Valley. Hardly anybody knew the difference.

European anatomists started to figure out the distinction by making side-by-side comparisons. The teeth of mammoths and modern elephants both have relatively flat running-shoe corrugations on the biting surface. But the teeth of the *incognitum* are studded with fierce-looking rows of large conical cusps. That difference not only indicated that Siberian mammoths and the *incognitum* were separate species, it also led some anatomists to regard the latter as a flesh-eating monster.

"Though we may as philosophers regret it," the British anatomist William Hunter wrote in 1768, "as men we cannot but thank Heaven that its whole generation is probably extinct." Benjamin Franklin, then on diplomatic duty in London, observed that the animal's big tusks would have been an impediment "for pursuing and taking Prey." Ever the practical thinker, he suggested that those fierce-looking teeth might be "as useful to grind the small branches of Trees, as to chaw Flesh"—and he was right. We now know that mammoths predominated in the open grasslands of the American West and in Siberia, where they needed flat teeth for eating grass. The *incognitum*, a smaller animal with less curvature to its tusks, lived mostly in the heavy forests east of the Mississippi River and browsed on tree branches.

Those teeth also eventually gave the *incognitum* a name. To the young French anatomist Georges Cuvier, the coni-

cal cusps looked like breasts. So in 1806, he named the *incognitum* "mastodon," from the Greek *mastos* (for "breast") and *odont* (for "tooth"). But laymen went on applying the name "mammoth" to either species—and to just about anything else really big.

The discovery of such monstrous creatures raised troubling questions. Cuvier made the case that both mammoths and mastodons had vanished from the face of the earth; their bones were just too different from any known pachyderm. It was the first time the scientific world accepted the idea that any species had gone extinct—a challenge to the doctrine that species were a permanent, unchanging heritage from the Garden of Eden. The disappearance of such creatures also cast doubt on the idea that the earth was just 6,000 years old, as the Bible seemed to teach.

In fact, mammoths and mastodons shook the foundations of conventional thought. In place of the orderly old world, where each species had its proper place in a great chain of being, Cuvier was soon depicting a chaotic past in which flood, ice and earthquake swept away "living organisms without number," leaving behind only scattered bones and dust. That apocalyptic vision of the earth's history would haunt the human imagination for much of the 19th century.

At the same time, mammoths and mastodons gave Americans a symbol of national might at a time when they badly needed one.

The French anatomist Georges Cuvier (right: an undated portrait) coined "mastodon" from the Greek words for "breast" and "tooth." The conical ridges on the tooth in question (middle) were for grinding branches—not flesh, as had been believed. The mammoth's tooth (far right) was better for eating grasses.

GIANNI DAGLI ORTI / ART ARCHIVE / PICTURE DESK; THOMAS JEFFERSON FOSSIL COLLECTION / ACADEMY OF NATURAL SCIENCES, PHILADELPHIA; ALBERT COPLEY / VISUALS UNLIMITED

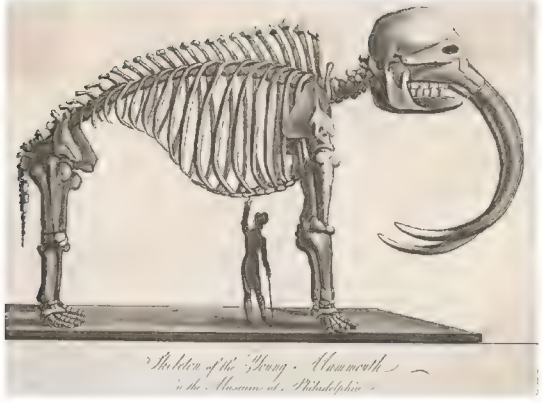
GEORGES-LOUIS LECLERC, Comte de Buffon, the French naturalist, had declared that "a niggardly sky and an unprolific land" caused species in the New World—including humans—to become puny and degenerate. "No American animal can be compared with the elephant, the rhinoceros, the hippopotamus," he sniffed in 1755. Even the American Indian is "small and feeble. He has no hair, no beard, no ardour for the female." Because Buffon was one of the most widely read authors of the 18th century, his "theory of American degeneracy" became conventional wisdom, at least in Europe.

Clearly offended, Thomas Jefferson (who stood 6-foot-2) constructed elaborate tables comparing American species with their puny Old World counterparts—three-and-a-half pages of bears, bison, elk and flying squirrels going toe-to-toe. In the early 1780s, he wrote that the mammoth, "the largest of terrestrial beings," should have "stifled in its birth" Buffon's notion "that Nature is less active, less energetic on one side of the globe than she is on the other. As if both sides were not warmed by the same genial sun; as if a soil of the same chemical composition was less capable of elaboration into animal nutriment." When Jefferson sailed to Paris in 1784 to represent the new United States, he packed "an uncommonly large panther skin" with the idea of shaking it under Buffon's nose. He later followed up with a moose. (Buffon promised to amend his errors in the next edition of his book, according to Jefferson, but died before he could do so.)

It wasn't just a matter of wounded pride. For American envoys in the 1770s and '80s, refuting the idea of innate inferiority was essential "if they were to obtain sorely needed financial assistance and credit in Europe," says anthropologist Thomas C. Patterson. And they took every opportunity to make their point. Once, at a dinner in Paris, a diminutive Frenchman (in recounting the story, Jefferson described him as "a shrimp") was enthusiastically preaching the doctrine of American degeneracy. Benjamin Franklin (5-foot-10) sized up the French and American guests, seated on opposite sides of the table, and proposed: "Let us try this question by the fact before us. . . . Let both parties rise, and we will see on which side nature has degenerated." The Frenchmen muttered something about exceptions proving rules.

In Philadelphia, the portrait artist Charles Willson Peale first examined *incognitum* bones from the Ohio River Valley in 1783, and the encounter set him on what he called an "irresistibly bewitching" quest for knowledge about the natural world, leading him to create what was in effect America's first national museum. (The Smithsonian Institution was still more than a half-century in the future.) Tickets to Peale's museum, in Philadelphia, bore the slogan "The Birds & Beasts will teach thee," and he saw to it that they taught lessons in the greatness of the American republic.

For Peale, the massive size of the *incognitum* made it the perfect answer to Buffon's "ridiculous idea," and in 1801 he got word of "an animal of uncommon magnitude" discovered by a farmer named John Masten in the Hudson River Valley near Newburgh, New York. That June, Peale traveled by stagecoach and sloop from Philadelphia to Newburgh, where he paid $200—roughly $2,500 in today's currency—for the bones, plus $100 more to do additional digging on his own. Before long, he had a $500 loan from the American Philosophical Society, a science and natural history organization of which Jefferson was then president, to support an ambitious effort to excavate bones from a pond on Masten's farm.



The idea of an "animal of uncommon magnitude" led the artist Charles Willson Peale to lead a dig in the Hudson River Valley—and to paint the proceedings (above). He added a few mastodon bones to a pile previously found at the site, but when he showed the skeleton (left) at his Philadelphia museum, he mistakenly pointed the tusks downward.

Peale commemorated the scene in a famous painting (above), with lightning crackling down from a black corner of the sky and horses panicking in the distance. To drain the pond that dominates the scene, Peale had devised a huge wooden wheel on a high bank, with men treading inside like hamsters in an exercise wheel. The turning of the wheel drove a long conveyor belt of buckets, each carrying water up and over, to spill down a chute into a nearby vale. Workers on staged platforms passed dirt up from the exposed bottom of the pond. In the lower right quadrant of the painting, Peale himself presided, grandly presenting the scene with one outstretched arm.

The painting was originally titled *Exhuming the Mammoth*, but the excavation at the pond actually recovered only a few more bones to add to Masten's original discovery. Peale did better with two less picturesque excavations up the road, recovering a nearly complete skeleton. But the painting made for a shrewd piece of self-promotion.

Back in Philadelphia, making sense of the bones took three months and "numberless trials of putting first one piece, then another, together, and turning them in every direction." Peale's slave Moses Williams did much of the work. He "fitted pieces together by trying, [not] the most probable, but the most improbable position, as the lookers-on believed," Peale wrote. "Yet he did more good in that way than any one among those employed in the work." Peale filled in missing parts in papier-mâché and wood, scrupulously indicating these substitutions. But the showman or patriot in him exaggerated the size of his *incognitum* slightly, yielding a skeleton 11 feet high at the shoulder. Later, he corked the joints, adding extra "cartilage" to make it even bigger. For a time, he also pointed the tusks downward, the better for skewering prey.

To drum up business for the opening of his museum, Peale had Williams put on an Indian headdress and parade through the city streets on a white horse, with trumpet fanfare. Fliers invoked an Indian legend: "TEN THOUSAND MOONS AGO" a creature had roamed "the gloomy forests . . . huge as the frowning Precipice, cruel as the bloody Panther." For 50 cents additional admission to the museum's "Mammoth Room," Philadelphians could see "the LARGEST of Terrestrial Beings!" with their own wide eyes.

It was only the world's second reconstruction of a fossil

GRANGER COLLECTION, NEW YORK; MARY EVANS PICTURE LIBRARY

France's Comte de Buffon (left) and Thomas Jefferson (far right) argued over which continent's wildlife was bigger. In America's favor: the 15-foot-tall giant short-faced bear (right) and a 13-foot-tall mammoth skeleton (above: at the University of Nebraska).

species (the one prior attempt being a decidedly less thrilling giant ground sloth in Madrid), and it became a national sensation, with word spreading until "the masses of the people were now even more eager than the scientists to view the great American wonder," according to Peale biographer (and descendant) Charles Coleman Sellers. "The mere idea of bigness stirred every heart." Peale's "mammoth" would turn out to be a mastodon, but "mammoth" was the word on every tongue, gaining overnight "a fresh and spectacular currency." A Philadelphia baker offered "Mammoth Bread." In Washington, a man who proclaimed himself a "Mammoth Eater" dispatched 42 eggs in ten minutes, and a New Yorker grew a 20-pound "mammoth" radish. Knowing of President Thomas Jefferson's long interest in all things mammoth, the women of Cheshire, Massachusetts, presented him with a 1,230-pound "Mammoth Cheese" on New Year's Day 1802.

Politics also infected a publicity stunt staged by Peale's son Rembrandt. Thirteen gentlemen sat at a round table beneath the "mammoth's" monstrous rib cage while a musician played "Jefferson's March" and "Yankee Doodle" at a piano tucked under the pelvis. The diners offered patriotic toasts, being careful not to raise their glasses too high: "The American People: may they be as preeminent among the nations of the earth, as the canopy we sit beneath surpasses the fabric of the mouse!" Young Peale soon boarded a ship with the second skeleton from the Hudson River Valley to show off in Europe.

Caught up in the effort to prove the vitality of the American experiment, Thomas Jefferson had convinced himself by the 1780s that the mammoth still lived. He gave credence to an Indian legend about a mammoth that shook off lightning bolts, bounding away over the Ohio River to somewhere beyond the Great Lakes. "In the present interior of our continent," Jefferson wrote, "there is surely space and range enough for elephants and lions." He imagined this pair of American titans roaming the Great Plains.

Buffon's theory of American degeneracy was still on Jefferson's mind years later, when, as president, he sent Lewis and Clark to explore the American West—partly to see if they

Find out more about these ice age beasts at Smithsonian.com/mammoths

PETER MENZEL / PHOTO RESEARCHERS; NORTH WIND PICTURE ARCHIVES; JOE VENUS / WWW.JOEVENUSARTIST.COM; GRANGER COLLECTION, NEW YORK

could turn up a living mammoth. He was so obsessed with this quest that he once laid out a collection of mastodon and other bones on the floor of the East Room in the White House, where John and Abigail Adams' laundry had once hung.

JEFFERSON WAS RIGHT ABOUT THE ROBUSTNESS of American wildlife. At Larry Agenbroad's dig at the Mammoth Site in South Dakota, a volunteer from the Earthwatch Institute carefully scrapes dirt from around the rib of a giant short-faced bear, the largest bear species ever known. It weighed 1,200 pounds or more and could stand 15 feet high, half again the regulation height of a basketball rim. Bears, wolves and other carnivores apparently preyed on mammoths struggling at the edge of the thermal pool—and sometimes also died there. Agenbroad has not yet found any lion bones among all the mammoth remains at the site, but just as Jefferson suspected, an American lion—25 percent larger than its modern African counterpart—also once roamed the Great Plains.

Columbian mammoths, the North American species named for Christopher Columbus, stood up to 14 feet tall at the shoulder, towering two feet over African elephants. One woolly mammoth, at most ten feet tall, has also been found at the site, dating to an undetermined time when the climate got colder and Columbian mammoths moved south. There are no mastodons at the site, and in the spirit of geographic one-upmanship, Agenbroad dismisses those eight- to ten-foot-tall Easterners as deficient—though not quite degenerate—cousins.

Dynamics of demise: a trapped mammoth struggles to exit a pit.

Agenbroad first came to the Hot Springs site in July 1974 on a quick visit from a bison dig an hour or so south. George "Porky" Hanson, a bulldozer operator, had scraped up a mess of bones while getting the area ready for a housing development. Hanson's son, who had taken a course from Agenbroad at Chadron State College in Nebraska, sent him a note: "We think we have mammoths in Hot Springs."

They did, and digging commenced in earnest in 1975. The housing developer agreed to back off for three years and, after the scope of the discovery became apparent, sold the property at cost to a nonprofit foundation that Agenbroad helped establish. Work on the site since then has produced—along with 116 tusks and tons of bones—an explanation of what happened there 26,000 years ago.

Some of the Mammoth Site animals died at first snow, according to Agenbroad, and others during an early spring thaw. (Researchers determined the season of death with the help of trace isotopes in different tusks.) The ice age winter, Agenbroad says, left mammoths with two choices: "They could sweep off three feet of snow and get last year's grass, which is about as exciting as a bowl of cereal with no sugar, berries or milk. Or they could go for the salad bar of plants still growing around the edge of the sinkhole—just like bison in Yellowstone National Park go for the green grass around thermal pools."

But the sides of the sinkhole sloped at least 67 degrees, Agenbroad estimates, and the stone—Spearfish Valley red shale—gets as slick as grease when wet. Only males were dumb enough to risk it, he figures, because female mammoths stayed within the shelter of the herd their entire lives, like modern elephants. But adolescent males went into exile—and did the sort of imprudent things adolescent males still do today.

Early in the excavation, the concentrated pattern of bones made it practical to think about putting the whole site under a roof. "We made the decision to leave the bones where they were," Agenbroad says. "They never look the same on a shelf." The Mammoth Site foundation's board of directors has always been notably local (Porky Hanson was a member), but Agenbroad persuaded them of the value of emphasizing science, not just tourism. The site now attracts 110,000 visitors a year.

OUT ON A PART OF THE EXCAVATION she calls her "airstrip," a volunteer named Ruth Clemmer uses a square trowel to make thin shavings of dirt buckle up and away. This is the end of her fifth two-week work session over the past three years, and she can add up what she's found in that time: one toe bone the size of her fist, one coprolite (fossilized excrement, probably from a wolf) and many mammoth rib fragments. Ribs are cheap around here, since each animal had 40 of them. "If we had a barbecue joint, we'd be in business," jokes another volunteer.

It's almost enough to give Clemmer an inferiority complex. But then she gets onto an interesting piece of bone and starts to "develop" it, going back and forth between the trowel and, for close work, a sharpened popsicle stick, with a pastry brush for cleanup. The bone gradually widens out and turns a corner. The crew chief comes by and speculates that it might be the coracoid process of a shoulder blade. Or not: "It has a lot of calcite on it, which conceals the shape." Clemmer announces that she's skipping the afternoon break so she can keep digging.

"It'll still be here next year," the crew chief advises. It's Friday afternoon, the last day of work for this crew, but Clemmer makes a deal with Agenbroad to let her dig the following day while everybody else goes off on a field trip.

When Agenbroad gets back late Saturday afternoon, he looks down at Clemmer's work and says, "Nuchal crest," meaning the anchor point for the massive muscles that once stretched up across the back of the neck. The bone is, in fact, the complete skull of a male mammoth brought down in his prime. The animal lies on his right cheek. The top of his left eye socket just barely peeks up above the dirt. Clemmer goes home triumphant, having assisted one more ice age American hero into the light of a strange new world.

RICHARD CONNIFF *is a frequent contributor to* SMITHSONIAN.

MARK HALLETT PALEOART / PHOTO RESEARCHERS

AS REPORTS OF RIOTS IN INDONESIA flashed across the world's news wires, in May 1998, my wife telephoned the hotel in Jakarta where I was staying to make sure I was OK. "What do you see out your window?" she asked. Flames from burning department stores and Chinese shops and businesses owned by the family of President Suharto spread across the horizon like a magnificent sunset. Army tanks and soldiers with dogs filled the square below. "I see a city burning," I said, "a city dying."

At the time it seemed no exaggeration. Indonesia's economy and its currency, the rupiah, had collapsed in a financial crisis that gripped all of Southeast Asia. In parts of the Spice Islands, which belong to Indonesia, tensions between Muslims and Christians were escalating. In the nation's province of Aceh, and in Papua, site of one of the world's richest deposits of copper and gold, the death toll mounted as secessionists skirmished with the army. East Timor was about to fall into anarchy, then secede from Indonesia as an independent country. In Jakarta, the nation's capital, student protesters seeking to replace three decades of dictatorship with democracy were brutally put down by the military and government thugs, sparking clashes that would claim 1,200 lives and 6,000 buildings. Hardest hit was the Chinese minority, long resented for their entrepreneurial success; their businesses were looted and destroyed, and women were raped by hired military goons. Tens of thousands of Chinese fled the country.

I was then a reporter for *The Los Angeles Times*, based in Hanoi, and I was covering the civil unrest in Jakarta. One day I came upon an anti-Suharto demonstration at Trisakti, a private university. Students at other colleges sometimes taunted Trisakti's students, belittling their lack of political involvement by waving bras and panties at them. But on this

RETURN TO INDONESIA

A reporter who saw the nation go up in flames now finds it has a new hold on prosperity

BY DAVID LAMB

After rioting and other crises ravaged Indonesia in 1998 (opposite: inset), the world's most populous Muslim nation overthrew its dictator and embraced political reforms. Despite ongoing problems, today (here: Jakarta) it boasts one of Asia's strongest economies.

day Trisakti's young men challenged the soldiers, standing shoulder to shoulder and pushing against their lines. "Don't get so close. You could get shot and killed," a friend of 19-year-old Trisakti student Elang Lesmana warned him. "That's OK," Lesmana replied. "I'd be a hero." The soldiers, who had exchanged their rubber bullets for real ones, killed Lesmana and three other students. The deaths galvanized Indonesia, turning the tide of public and military sentiment.

Suharto's top general, Wiranto—like Suharto and many Indonesians, he has only one name—told the president the military could no longer protect him and had no intention of staging a Tiananmen Square-style massacre in Jakarta. Nine days after the shootings of students, on May 21, Asia's longest-serving leader resigned. He retired to the family compound in a leafy Jakarta suburb to live out his final decade watching TV, surrounded by a stuffed tiger and bookshelves full of cheap souvenirs and trinkets. Caged songbirds sang on his terrace.

For 32 years Suharto had run Indonesia like the CEO of a family corporation. The Suhartos' fortune reportedly topped $15 billion, and they had a major stake in more than 1,200 companies. But Suharto left behind more than a legacy of corruption and a military best known for its deadly abuse of human rights. He had also been Indonesia's father of development, building schools and roads, opening the economy to foreign investment, transforming dusty, tropical Jakarta into a modern capital and lifting millions of Indonesians out of poverty.

THE WORLD'S MOST POPULOUS Muslim country, with 240 million people, Indonesia has always been an ungainly place. The archipelago encompasses 17,500 islands—6,000 inhabited—that stretch 3,200 miles across the Pacific Ocean's so-called Ring of Fire where earthquakes and volcanoes are a constant threat and tsunamis are born. The people—88 percent Muslim—speak scores of local languages and represent dozens of ethnic groups. As recently as the 1950s the population included tribes of headhunters. That this polyglot was born as a single nation in 1949, after 300 years of Dutch rule and four of warfare and negotiations with the Netherlands, was a miracle in itself.

After witnessing the Suharto-era meltdown, I did not return to Indonesia until October 2009, after I had begun hearing about changes unimaginable a decade earlier. On the surface, Jakarta didn't seem much changed. Traffic remained gridlocked in the humid 90-degree heat. Shantytown slums languished in the shadow of marbled shopping malls where pianists in tuxedos played Chopin next to Valentino and Louis Vuitton shops, and white-gloved valets parked cars. The Indonesians I encountered were, as always, gracious and friendly, and I could walk virtually any street, even at night in a city of nine million people, with no fear for my safety. On one block you'd still find a mosque packed with men who considered alcohol and dancing ungodly, on the next, a nightclub like the Stadium that served alcohol 24 hours a day on weekends and boasted a disco pulsating with lights, thunderous rock music and writhing young bodies.

But beneath the surface, everything was different. Indonesia had recovered from half a century of dictatorship—first under Sukarno, then Suharto—and in the time I'd been away had become what Freedom House, a U.S. think tank, called the only fully free and democratic country in Southeast Asia. The outlying islands were generally calm. Soldiers no longer careered with abandon through city streets in cars bearing the red license plates of the military command. The unthinkable had happened: Indonesia had become one of the region's most stable and prosperous nations.

People seldom talked about the dark past, not even of the apocalyptic end of the Sukarno regime in the mid-1960s, when the army and vigilantes went on a madhouse slaughter to purge the country of leftists, real and imagined. The killings spread from Jakarta to the Hindu-dominated island of Bali, and by the time order was restored as many as half a million had lost their lives. The mayhem was captured in the 1982 movie starring Mel

CONTINUED ON PAGE 49

From left: presidents Sukarno and Suharto ruled with iron fists, leading to protests in 1998 that killed Hirratetty Yoga's son, Elang (in photograph). Indonesia's president—and pop song writer—Susilo Bambang Yudhoyono was re-elected in a landslide in 2009.

GETTY IMAGES; MAYA VIDON / GETTY IMAGES; DAVID LAMB; ROMEO GACAD / AFP / GETTY IMAGES; P. 46 JOHN STANMEYER / VII; PP. 46-47 ED WRAY

"We've got a real democracy," says a Jakarta columnist, but people worry about "hard-liners who want an Islamic state."

CONTINUED FROM PAGE 48

Gibson and Linda Hunt, *The Year of Living Dangerously*.

Today Indonesia has joined the Group of 20, the world's premier forum for economic cooperation. Blessed with an abundance of natural resources—petroleum, natural gas, timber, rubber and various minerals—and a strategic position straddling one of the world's most important shipping lanes, it is one of Asia's fastest-growing economies.

"There was great euphoria when Suharto stepped down, but it opened a Pandora's box," said Julia Suryakusuma, a Jakarta newspaper columnist. "Yes, we've got a real democracy. The world's third largest after India and the United States. That's pretty amazing. But what people worry about now is Islamization, the hard-liners who want an Islamic state."

A SOFT RAIN WAS FALLING the night Fanny Hananto came to pick me up at my hotel. I jumped on the back of his motorcycle, and we slipped through lines of idling, bumper-to-bumper cars, headed for the mosque he attends. We passed a large group of women with small children, collectively called traffic jockeys, on a sidewalk. Hananto said solo motorists would pay a mother and child 25,000 rupiah (about $2.50 U.S.) to be passengers so the driver could use the lane reserved for cars occupied by three or more people.

I had met the 37-year-old Hananto through a friend. With his scraggly beard and a wife who dressed in black, everything covered but her eyes, and a daughter named for one of the Prophet Muhammad's wives, Hananto seemed the very personification of Islamic purity. Had he always been religious?

"Not exactly," he said. As a younger man, he had worked on a cruise ship, spent nights partying with drugs and alcohol and, referring to the crowd that hung out at the Stadium nightclub, said, "I was one of them." But about a dozen

ALEXANDRA BOULAT / VII; MAP: GUILBERT GATES

MEDIA INDONESIA
Amerika Pilih Presiden
Dirjen Migas Usul Harga BBM Turun Rp500-Rp800 per Liter
Kotak Pandora dari Jawa Timur

Jakarta readers, enjoying an easing of press restrictions, avidly tracked former resident Barack Obama's 2008 campaign.

years ago he grew to fear the wrath of Allah and did a 180-degree turn, embracing Islam through the Kebon Jeruk Mosque, to which he was now taking me. He so deeply trusted the imam who mentored him that when the cleric said he had found a good woman for Hananto, and showed him her picture, Hananto said, "OK, I will marry her." He did so a short time later, never mentioning his past life to her.

I removed my shoes as we entered the mosque, fearing I might lose them amid the piles of footwear strewn about. Thursday evening prayers had attracted so many men, perhaps 2,000, that I could not even see the visiting Pakistani cleric preaching at the front. The men were members of an apolitical Islamic movement, Tablighi Jamaat, that strives to make Muslims better practitioners of their faith. I squatted on the floor, and men in long, loose-fitting white shirts and turbans nodded in welcome or reached out to shake my hand. Hananto introduced me to his friend, Aminudia Noon, a university professor of civil engineering. I asked him where the women were.

"They're home praying," he said. "If they were to come here, it would be like an arrow to the heart from Satan."

Islam was brought to Indonesia not by conquest but by 12th-century Muslim traders who took cloves, nutmeg and other spices to the West. Its spread was gradual and peaceful. Rather than smothering local culture and religions—Hinduism, Buddhism, mysticism—it absorbed them. The Islam that took root was less doctrinaire and less intolerant than some forms practiced in the Middle East, and no one found it particularly unusual that Suharto meditated in caves and consulted astrologers and clairvoyants.

Both Sukarno and Suharto were leery of fervent Islam. Sukarno feared it could threaten the stability of his diverse, fragile country and at independence rejected the idea of making Indonesia an Islamic republic. Suharto kept his distance from the Arab Muslim world and for years kept Islamists at home on a short leash. Some went underground or left for more comfortable lives in neighboring Malaysia, which is also Islamic.

I told Professor Noon I didn't understand how Muslim terrorists who had killed countless innocents in Indonesia and other countries could be considered martyrs. "Those who believe that have misinterpreted Islam," he said. "The basic theme of Islam is love and affection. How can you put people who make bombs in paradise? Suicide bombers are not martyrs. They have lost the blessing of Allah, and they will receive His greatest punishment in the hereafter."

Indonesia after Suharto's fall was buffeted by drift, strife and communal conflict. Islamic extremists emerged from the shadows—and with them the country's first suicide bombers. In Java, the island where Jakarta is located, mysterious assassins brutally killed scores of suspected black-magic sorcerers.

Meanwhile, between 1998 and 2004 three unlikely chief executives shuttled in rapid succession through the presidency—a millionaire engineer educated in East Germany, a nearly blind Muslim cleric, who often dozed off in meetings and was eventually impeached, and Sukarno's daughter, whose most notable credential was her father's genes.

Enter, in 2004, Susilo Bambang Yudhoyono, then a 55-year-old retired general who had been educated in the Unit-

CHRIS JACKSON / GETTY IMAGES

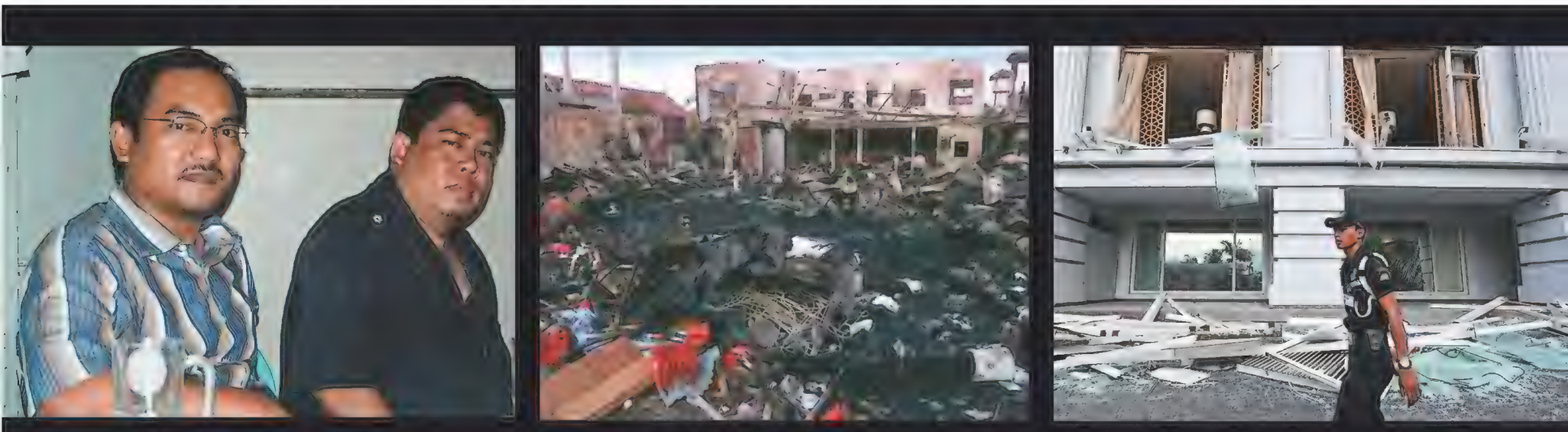
ed States and who, as a youth, had sung and played guitar in a band named Gaya Teruna (Youth Style). He had a clean, graft-free reputation, a dedication to democracy and a belief that Indonesia's traditionally tolerant, moderate form of Islam—Smiling Islam, Indonesians call it—was the true expression of the faith. The local news media referred to him as "the thinking general" and seemed delighted when, at a campaign stop in Bali, he sang John Lennon's song "Imagine" in English. No one seemed to mind that it offered a distinctly atheistic outlook:

Imagine there's no Heaven . . .
No hell below us . . .
And no religion too.
Imagine all the people
Living life in peace . . .

On September 20, 2004, some 117 million Indonesians voted in the largest single-day free election the world had ever seen to make Yudhoyono, who had promised to continue to reform the nation and the military and to rein in terrorism, the country's sixth president. Five years later, he was re-elected in a landslide, collecting more direct votes (74 million) than any candidate had ever won worldwide. (The previous record had been Barack Obama's 69 million votes in 2008.) In a nod to austerity, Yudhoyono's second inauguration in October 2009 cost a mere $30,000.

Last year, *Time* magazine named Yudhoyono one of the world's 100 most influential people. Not only has he continued with reforms to curb the military's role in society, but he also struck a peace deal with anti-government rebels in Aceh province on the northern tip of Sumatra, ending a nearly 30-year war that had claimed 15,000 lives. Arrests, executions and raids had seriously weakened Jemaah Islamiyah (JI), a homegrown Al Qaeda look-alike considered Southeast Asia's deadliest terrorist group. (The name means "Islamic Community.") Freedoms have continued for the Chinese minority, numbering about five million people or roughly 2 percent of the population, who had become free to use Chinese characters on its storefronts, celebrate Chinese New Year and openly teach the Chinese language. "Things are more secure, much better. We'll see," said Ayung Dim, 57, a merchant who had survived the 1998 riots by hiding with his family in his metal shop before fleeing to Malaysia.

The Indonesian government also patched up relations with the United States. It laid the groundwork for the return of the Peace Corps, expelled four decades earlier by the anti-Western Sukarno, who taunted the American ambassador, Marshall Green: "Go to hell with your aid!" Yudhoyono threw his support behind an anti-corruption commission, which caught some big fish, including his own daughter-in-law's father. Indonesia's democratic transformation and political reform have brought about a resumption of military cooperation with the United States, which had been suspended because of the Indonesian Army's abysmal human-rights record.



From left: Former Islamic terrorists Nasir Abas and Jhoni "Idris" Hendrawan have helped authorities in the fight against terrorism in the wake of deadly attacks, including bombings at Bali's Sari Club in 2002 and at the Ritz-Carlton hotel in Jakarta in 2009.

DAVID LAMB; BRETT HARTWIG / NEWSPIX / GETTY IMAGES; ROMEO GACAD / AFP / GETTY IMAGES

THE DAY BEFORE YUDHOYONO'S second swearing-in, I took a taxi to the English-language *Jakarta Post* to see how the media had fared under him and what had changed since Suharto, when insulting the president or vice president was a crime and newspapers could be closed after printing three objectionable articles.

The privately owned *Post*, one of 16 national newspapers, had recently moved into a sparkling new building. I was surprised to find an empty newsroom. I asked the editor, Endy Bayuni, where everyone was. "They're out doing what reporters are meant to do—*reporting*," he said. "There are no government restrictions any more, no issues we can't report on. With all the corruption here, Indonesia is a gold mine for investigative reporters, but our reporters don't have the skills yet to do that kind of reporting well because we weren't allowed to do it for so long. We're retraining them."

"In the old days," he went on, "we became famous as the

paper you had to read between the lines to understand. We'd push the invisible line as far as we could. It was the only way to keep your sanity as a reporter. Every segment of society has a voice now, even if it's an unwanted voice" like that of Islamic extremists.

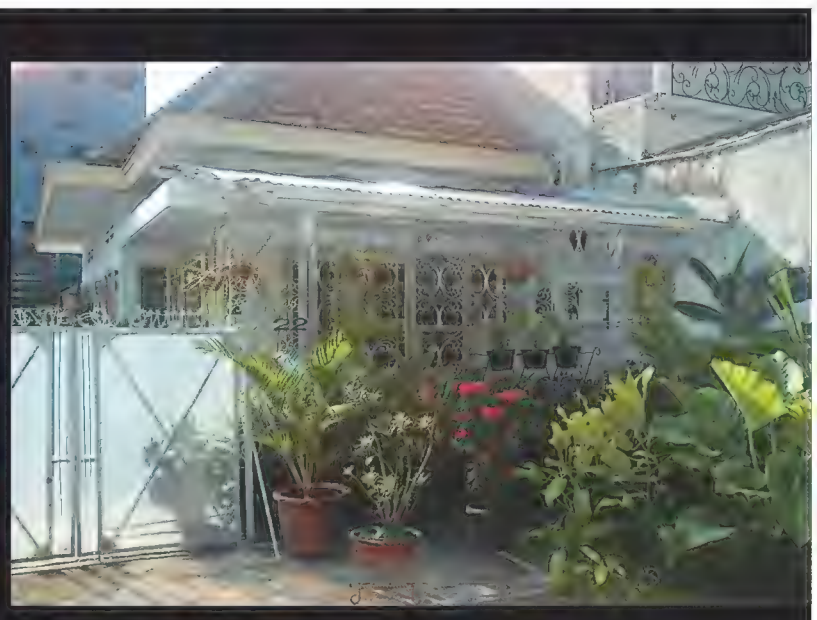
One branch of Islam has resurfaced here in its hard-core, anti-Western jihadist form. The terrorist group Jemaah Islamiyah first captured the world's attention in 2002 when a young suicide bomber with a backpack and a car loaded with explosives leveled two tourist bars, Paddy's Pub and the Sari Club, on the Indonesian island of Bali. Over 200 people from 23 countries died. A marble memorial now marks the spot where Paddy's stood, and a new bar has opened nearby with the name Paddy's: Reloaded. In the next seven years terrorists launched several additional, deadly attacks—on restaurants in Bali and Jakarta, two at the JW Marriott and one each at the Ritz-Carlton and the Australian Embassy.

Though diminished by arrests and internal strife, JI and splinter terrorist groups still pose a big challenge to the fulfillment of Yudhoyono's campaign promise that "God willing, in the next five years the world will say, 'Indonesia is something; Indonesia is rising.'"

tacks in Indonesia and been arrested while counting the money he had robbed from a bank to finance a future attack.

These days Abas has a new role: he works for the police. Abas helped officers question suspects responsible for the second Bali bombing. He has testified against JI operatives in court, leading to their conviction and imprisonment. His encyclopedic knowledge of the terrorist network provided authorities with a trove of intelligence. He is one of the first on the scene of terrorist attacks and often finds clues that only a JI insider would recognize. In his spare time he visits terrorists in Cipinang and other prisons, trying to convince them that killing civilians and innocents is un-Islamic. Some prisoners refuse to talk to him and call him a traitor; others, like Hendrawan, have bought into Abas' deradicalization program and have forsworn violence. "I thought the students I trained would take part in jihad against forces occupying Muslim lands, like in Afghanistan," Abas said. "Then the Bali bombing. This wasn't jihad. Prophet Muhammad said it is wrong to do anything cruel, wrong to kill old men, women and children. After Bali, I came to realize many of my friends and relatives had strange ideas and thought it was OK to kill civilians."

His conversion, he said, came after his 2003 arrest. "I al-



From left: President Obama (with President Yudhoyono and first ladies in Pittsburgh in September 2009) remains popular in Indonesia; despite this, protesters got his statue removed from a city park. His boyhood home attracts tourists and residents alike.

CHARLES DHARAPAK / AP IMAGES; ACHMAD IBRAHIM / AP IAMGES; DAVID LAMB

I MET NASIR ABAS IN A DINGY Jakarta coffee shop across the road from Cipinang Prison, which holds some of Indonesia's toughest criminals and most incorrigible terrorists. Abas' own terrorist credentials were formidable. He had trained on the Pakistan-Afghanistan border, set up a military academy in the jungles of the southern Philippines and taught half a dozen of the young men who carried out the first Bali bombing how to kill. His brother spent eight years in a Singapore prison for plotting a foiled terrorist attack. (He was released in January.) His brother-in-law was executed for his role in the bombing of Paddy's and the Sari Club. Abas, 40, brought along a sidekick, Jhoni "Idris" Hendrawan, 34, who had taken part in three deadly terrorist attacks in Indonesia and been arrested while counting the money he had robbed from a bank to finance a future attack.

These days Abas has a new role: he works for the police. Abas helped officers question suspects responsible for the second Bali bombing. He has testified against JI operatives in court, leading to their conviction and imprisonment. His encyclopedic knowledge of the terrorist network provided authorities with a trove of intelligence. He is one of the first on the scene of terrorist attacks and often finds clues that only a JI insider would recognize. In his spare time he visits terrorists in Cipinang and other prisons, trying to convince them that killing civilians and innocents is un-Islamic. Some prisoners refuse to talk to him and call him a traitor; others, like Hendrawan, have bought into Abas' deradicalization program and have forsworn violence. "I thought the students I trained would take part in jihad against forces occupying Muslim lands, like in Afghanistan," Abas said. "Then the Bali bombing. This wasn't jihad. Prophet Muhammad said it is wrong to do anything cruel, wrong to kill old men, women and children. After Bali, I came to realize many of my friends and relatives had strange ideas and thought it was OK to kill civilians."

His conversion, he said, came after his 2003 arrest. "I always thought the police were my enemy." But they called him Mr. Nasir and, after beating him the day of his arrest, never touched him again. If they had tortured him further, he said he would have been silent or given them false information. "They said, 'We are Muslim like you. We aren't against Islam. We just want to stop criminals.' Even the Christian cops didn't use bad words about Islam. I changed my mind about the police, and that was one turning point."

Another, he told me, was when Cipinang's commander came to see him in prison. "Bekto Suprapto was a colonel and a Christian. He told the ten men guarding me to take off my handcuffs. Then he told them to leave. I'm thinking, 'What a brave man, because if I want to do something to

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In 2009, Aceh province (a mosque in Bande Ache, site of 2004's tsunami) adopted a law calling for the stoning of adulterers.

him, I'm sure I could carry it off.' We talked about jihad, about Christians and Muslims. He gave me a Bible and I ended up reading it. I started wondering why God hadn't let me die or be killed. I answered my own question. He hadn't because there was something God wanted of me. It was to do what I'm doing now." Abas' change of direction also had a practical benefit: it won his release from custody.

Abas—and mainstream experts on terrorism—say JI continues to recruit at its 50 schools and in the mosques it operates. But, they add, its leadership and structure have been severely weakened by Yudhoyono's three-pronged strategy: first, to aggressively pursue terrorists, which has resulted in more than 400 arrests, several executions and the shooting death of JI leader Noordin Mohammad Top in 2009; second, to undercut the popular appeal of militancy by exposing it as un-Islamic; and lastly, to ensure that the government does not create more terrorists by treating prisoners brutally.

Recent elections offer a glimpse into the public's changing attitudes. In parliamentary elections in 2004, Islamic parties won 38 percent of the vote; in 2009, the percentage dropped to 23. In a poll of Indonesians by a group called Terror Free Tomorrow, 74 percent said terrorist attacks are "never justified." In another poll, 42 percent said religion should have no role in politics, up from 29 percent the previous year. Apparently, most Indonesians continue to embrace moderation and tolerance.

Indonesia's *ulema*, or leading clerics, were long on the fence about terrorism, believing no Indonesians nor any Muslims could have been responsible for the attacks. Many never denounced the Bali bombing but did condemn a police raid in East Java in 2005 in which JI's leading bomb master, Azahari "Demolition Man" Husin, was killed as a U.S.-trained counterterrorism unit raided his hide-out. Yudhoyono's vice president, Jusuf Kalla, invited leading clerics to his house for dinner. He spoke with them for 50 minutes. He showed them pictures of huge stockpiles of bomb-making equipment and weapons the police had found at the hide-out. Then he showed them videos of young suicide bombers saying their goodbyes before heading out on death missions in search of martyrdom. "Do you still believe the police shouldn't have raided the house?" Kalla asked. The clerics all agreed that the raid was justified. It was an important government victory to get influential opinion-makers on the record with a condemnation of terrorism.

"Indonesia has done far better than the United States combating terrorism as far as abiding by the rule of law goes," said Sidney Jones, a longtime U.S. resident of Jakarta and a conflict analyst with the Belgium-based International Crisis Group. "There have been no witch hunts, no Guantánamos, no water boarding." The Yudhoyono government, she said, treats terrorism as a law-and-order problem for the police, and the police in turn use what they call a "soft approach," as they did with Nasir Abas. Everyone is charged in open court with reporters present. "Because of the information coming out of the trials, the Indonesian public became convinced that the terrorists are Indonesians, not CIA and Mossad operatives," Jones said.

DAVID LAMB, *who traveled Asia extensively as a* Los Angeles Times *correspondent, is a regular contributor to* SMITHSONIAN.

ROMEO GACAD / AFP / GETTY IMAGES

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"Indonesia is not just about poverty and corruption and terrorism," says university student Muhammad Fajar (in glasses).

THE INDONESIA I VISITED this past October was a different country from the one I left a decade ago. Although 32.5 million of the country's people still live below the poverty line, most Indonesians no longer wake up hoping they can simply make it through the day. The students' agenda of the 1990s—democracy, civil order, economic opportunity, respect for human rights—had become the national agenda. Everyone I met seemed aware that Indonesia had been given something some countries never get: a second chance. The optimism was palpable. "If Indonesia were a stock, I'd be buying," said Eric Bjornlund, co-founder of Democracy International, Inc., a firm in Bethesda, Maryland, specializing in international democratic development.

But many challenges lie ahead. Yudhoyono's popularity rating remains high—75 percent in early 2010—but has fallen 15 percent since his election, partly because of scandals within his government and criticism that he is indecisive. What if it continues to fall and he alters course, back-tracking into the dictatorial ways of his predecessors? What about deep-rooted corruption, which has drawn protesters into Jakarta's streets; inertia in the civil service; the gap between rich and poor; and the continuing battle for the soul of Islam between moderates and extremists? In 2009, Aceh province, for instance, adopted a new Shariah law (law of God) that calls for death by stoning for adulterers. To the relief of moderates, concerned about tourism and foreign investment, Aceh has yet to carry out any stonings.

One day, I sat with six students in the shade of a kiosk at Jakarta's Paramadina University, which includes in its curriculum a course on anti-corruption. The two young women present wore colorful *jilbabs*, the Islamic scarf that covers the hair and neck. All six spoke excellent English. They wanted to know if I was on Facebook and what I thought of President Obama, who as this story went to press was planning a visit in March to Indonesia, where he lived with his mother and Indonesian stepfather from 1967 to 1971. He has become popular in Indonesia since his campaign and election, and this past December a 43-inch bronze statue was unveiled in a city park, depicting a 10-year-old Obama wearing schoolboy shorts with his outstretched hand holding a butterfly. (A protest campaign that began on Facebook, arguing that Obama is not an Indonesian national hero, succeeded in getting the statue removed from the park. Officials transferred it to Obama's former school in February.) I asked the students what their goals were. One wanted to be a computer programmer, another an entrepreneur, a third wanted to study in the United States.

"For me," said 20-year-old Muhammad Fajar, "the biggest dream is to be a diplomat. Indonesia can have a big place in the world, and I want to be part of it. But first we've got to show the world that Indonesia is not just about poverty and corruption and terrorism."

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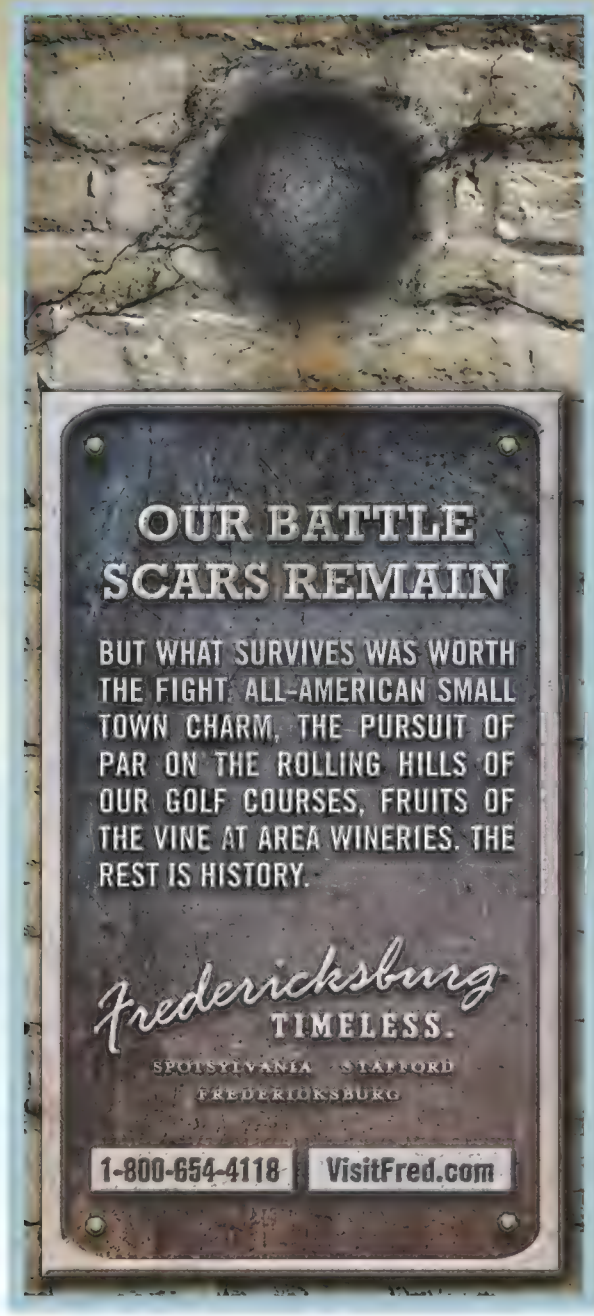
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SAVING THE SILKIES

IN MADAGASCAR, AN AMERICAN RESEARCHER LEADS THE EFFORT TO PROTECT ONE OF THE WORLD'S RAREST MAMMALS, A LEMUR CALLED THE SILKY SIFAKA BY ERICA R. HENDRY

PHOTOGRAPHS BY KEVIN SCHAFER

CLUSTERED IN THE MOUNTAINS of northeastern Madagascar, they are known locally as "ghosts of the forest," because they seem to flash through the trees. To scientists, silky sifakas are known as one of the world's rarest mammals. There are fewer than 1,000 still alive, perhaps only 100, says Erik Patel, a PhD candidate at Cornell University who has spent years observing the animals in the island nation's Marojejy National Park.

A type of lemur, a silky sifaka weighs between 11 and 14 pounds and measures up to three-and-a-half-feet long. Silkies "fly like angels," local people say, leaping as far as ten yards from tree to tree. "You could be following them and suddenly you look up and they're a quarter-mile away," says Kevin Schafer, a Seattle-based wildlife photographer who spent two weeks with Patel documenting the elusive primate.

The bone-white animal (a.k.a. *Propithecus candidus*) is called silky because of its luxurious fur. The word "sifaka," shared by several lemur species, echoes the screech—"shee-faak!"—made by some frightened lemurs, but not the silky.

People are the silkies' main threat. Some hunt them for food. Others burn their forest habitat to make room for rice fields. Loggers also destroy silky habitat when they cut down, illegally, valuable rosewood trees.

Patel works with communities to discourage logging and the hunting of silkies. He has taken children to see them in the wild and hired villagers to track them. Unless destruction of their habitat ceases, he fears, the animal will become a ghost in fact. "Time is quickly running out," he says.

Silky sifakas (right: engaged in grooming) have long eked out an existence in rugged, high-altitude forests (above: Leaning Rock in the Marojejy National Park). Now the growing number of people nearby pose a threat to the furtive primate.

View more of Madagascar's silky sifakas at Smithsonian.com/lemurs

The silkies' complex diet (opposite top left) consists of some 150 types of flowers, leaves, seeds and fruits and is one reason the lemur has not survived long in captivity. Usually traveling in groups of two to nine (above), the animals spend much of their day grooming one another and playing. Within a troop, parenting duties may be shared; females have been observed feeding infants that aren't their own or carrying them through the treetops. Silkies have long toes and an opposable big toe that lets them grab branches with their feet. The animals are so arboreal they even sleep aloft. Kevin Schafer's photograph of a frolicking trio (left), a rare view of silkies interacting on the ground, also highlights the pinkish face silkies have—a unique trait. "It must be one of the most difficult places to work in Madagascar," Erik Patel (opposite left) says of the mountainous rain forest where he studies silkies. "It is very steep and there is no formal trail system. [But] when the weather is good, it is just magical."

Of the 100 or so types of lemurs, all in Madagascar, only two are mostly white, including the silky sifaka, which has long, luxurious fur. The animal is also notable for leaping tree to tree (top), bounding ten yards at a jump and prompting some local residents to say the elusive creature flies like an angel. The silky sifaka (left and above) is listed along with four other lemur species as among the world's 25 most endangered primates, with only an estimated 100 to 1,000 individuals remaining. Most live within wilderness preserves, but timber thieves take rosewood, destroying habitat, and poachers hunt silkies for food. Animals outside protected areas are at even greater risk, says Patel: "It's hard to be optimistic about silky sifakas we find there."

ERICA R. HENDRY *is an editorial intern at the magazine.*
KEVIN SCHAFER *specializes in wildlife. His photograph of a flying scarlet macaw graced the cover of the December issue.*

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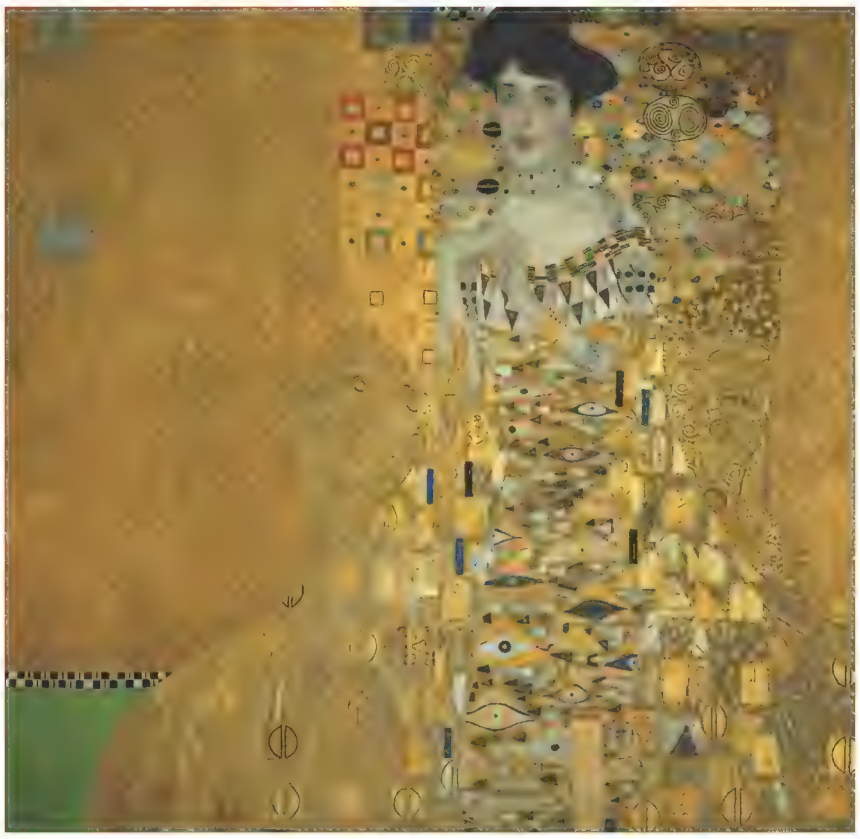

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Glimpses OF A Lost World

Threatened Buddhist art at a 900-year-old monastery high in the Indian Himalayas offers a rare look into a fabled civilization

BY JEREMY KAHN PHOTOGRAPHS BY ADITYA ARYA

The wood-framed door is tiny, as if intended for a Hobbit, and after I duck through it into the gloomy interior—dank and perfumed with the saccharine scent of burnt butter oil and incense—my eyes take a while to adjust. It takes my mind even longer to register the scene before me.

Mesmerizing colored patterns scroll across the wood beams overhead; the temple's walls are covered with hundreds of small seated Buddhas, finely painted in ocher, black, green, azurite and gold. At the far end of the room, towering more than 17 feet high, stands an unblinking figure, naked to the waist, with four arms and a gilded head topped with a spiked crown. It's a painted statue of the Bodhisattva Maitreya, a messianic being of Tibetan Buddhism come to bring enlightenment to the world. Two hulking statues, one embodying compassion and the other wisdom, stand in niches on side walls, attended by garishly colored sculptures depicting flying goddesses and minor deities. Each massive figure wears a dhoti, a kind of sarong, embellished with minutely rendered scenes from the life of Buddha.

These extraordinary figures have graced this small monastery in Alchi, a hamlet high in the Indian Himalayas along the border with Tibet, for about 900 years. They are

The 12th-century temple complex of Alchi contains an extraordinary concentration of unique Buddhist art (right: a 17-foot-high Bodhisattva Maitreya, messianic bearer of enlightenment). "The austere buildings of Alchi with their plain exterior," writes art historian Pratapaditya Pal, "jealously guard the resplendent world of form and color within its walls."

among the best-preserved examples anywhere of Buddhist art from this period, and for three decades—since the Indian government first allowed foreign visitors to the region—scholars have been trying to unlock their secrets. Who created them? Why don't they conform to orthodox Tibetan Buddhist conventions? Might they hold the key to rediscovering a lost civilization that once thrived, more than a hundred miles to the west, along the Silk Road?

The monastery and its paintings are in grave danger. Rain and snowmelt have seeped into temple buildings, causing mud streaks to obliterate portions of the murals. Cracks in clay-brick and mud-plaster walls have widened. The most pressing threat, according to engineers and conservators who have assessed the buildings, is a changing climate. The low humidity in this high-altitude desert is one reason Alchi's murals have survived for almost a millennium. With the onset of warmer weather in the past three decades, their deterioration has accelerated. And the possibility that an earthquake could topple the already fragile structures, located in one of the world's most seismically active regions, remains ever-present.

The Alchi murals, their vibrant colors and beautifully rendered forms rivaling medieval European frescoes, have drawn a growing number of tourists from around the world; conservationists worry the foot traffic may take a toll on ancient floors, and the water vapor and carbon dioxide the visitors exhale may hasten the paintings' decay.

Two years ago, an Indian photographer, Aditya Arya, arrived in Alchi to begin documenting the monastery's murals and statues before they disappear. A commercial and advertising photographer best known for shooting "lifestyle" pictures for glossy magazines and corporate reports, he once shot stills for Bollywood film studios. In the early 1990s, he was an official photographer for Russia's Bolshoi Ballet.

But Arya, 49, who studied history in college, has always harbored a more scholarly passion. He photographed life along the Ganges River for six years, in a project that became a book, *The Eternal Ganga*, in 1989. For a 2004 book, *The Land of the Nagas*, he spent three years chronicling the ancient folkways of Naga tribesmen in northeast India. In 2007, he traveled throughout India to photograph sculpture from the subcontinent's Gupta period (fourth to eighth centuries A.D.) for India's National Museum. "I think photographers have a social responsibility, which is documentation," he says. "[It] is something you can't shirk."

Scholars believe that patterns painted on Alchi's ceiling panels (above) may be modeled on ancient Kashmiri textiles. If so, the decorative elements may constitute a record of fabrics from a vanished medieval world. Virtually no artifacts from that lost civilization exist.

Alchi lies 10,500 feet up in the Indian Himalayas, nestled in a crook alongside the cold jade waters of the Indus River, sandwiched between the snowy peaks of the Ladakh and Zanskar mountains. From a point on the opposing bank, Alchi's two-story white stucco buildings and domed stupas resemble a crop of mushrooms sprouting from a small, verdant patch amid an otherwise barren landscape of rock, sand and ice.

Getting here entails flying from New Delhi to the town of Leh, sited at an altitude of more than 11,000 feet, followed by a 90-minute drive along the Indus River valley. The journey takes you past the camouflaged barracks of Indian Army bases, past the spot where the blue waters of the Zanskar River mingle with the Indus' mighty green and past a 16th-century fort built into cliffs above the town of Basgo. Finally, you cross a small trellis bridge suspended above the Indus. A sign hangs over the road: "The model village of Alchi."

Several hundred inhabitants live in traditional mud and thatch houses. Many women wearing customary Ladakhi pleated robes (*gonchas*), brocaded silk capes and felt hats work in the barley fields and apricot groves. A dozen or so guesthouses have sprung up to cater to tourists.

Alchi's status as a backwater, located on the opposite bank of the Indus from the routes invading armies traveled in the past and commercial truckers use today, has helped preserve the murals. "It is a kind of benign neglect," says Nawang Tsering, head of the Central Institute of Buddhist Studies, based in Leh. "Alchi was too small, so [the invaders] didn't touch it. All the monasteries along the highway were looted hundreds of times, but Alchi nobody touched."

Although Alchi's existence is popularly attributed to Rinchen Zangpo, a translator who helped promulgate Buddhism throughout Tibet in the early 11th century, most scholars believe the monastic complex was founded nearly a century later by Kalden Sherab and Tshulthim O, Buddhist priests from the region's powerful Dro clan. Sherab studied at Nyarma Monastery (which Zangpo had founded), where, according to an inscription in Alchi's prayer hall, "like a bee, he gathered the essence of wise men's thoughts, which were filled with virtue as a flower is with nectar." As a member of a wealthy clan, Sherab likely commissioned the artists who painted Alchi's oldest murals.

Who were these artists? The Dukhang, or Assembly

Photographer Aditya Arya (top right: in the Assembly Hall) is documenting Alchi's threatened architecture (top left: a three-tiered temple) and art, as well as its living traditions (left: a monk performs devotions). The need for a visual record, he says, "is something you can't shirk."

Hall, contains a series of scenes depicting nobles hunting and feasting at a banquet. Their dress—turbans and tunics adorned with lions—and braided hair appear Central Asian, perhaps Persian. The colors and style of painting are not typically Tibetan. Rather, they seem influenced by techniques from as far west as Byzantium. The iconography found in some of the Alchi murals is also highly unusual, as is the depiction of palm trees, not found within hundreds of miles. And there are the geometric patterns painted on the ceiling beams of the Sumtsek (three-tiered) temple, which scholars suspect were modeled on textiles.

Many scholars theorize that the creators of the Alchi murals were from the Kashmir Valley in the west, a 300-mile journey. And though the temple complex was Buddhist, the artists themselves may have been Hindus, Jains or Muslims. This might explain the murals' arabesques, a design element associated with Islamic art, or why people depicted in profile are painted with a protruding second eye, a motif found in illuminated Jain manuscripts. To reach Alchi, the Kashmiris would have journeyed for weeks on foot through treacherous mountain passes. Because of stylistic similarities, it is thought that the same troupe of artists may have painted murals in other monasteries in the region.

If the artists were Kashmiri, Alchi's importance would be even greater. In the eighth and ninth centuries, Kashmir emerged as a center of Buddhist learning, attracting monks from throughout Asia. Though Kashmir's rulers soon reverted to Hinduism, they continued to tolerate Buddhist religious schools. By the late ninth and tenth centuries, an artistic renaissance was underway in the kingdom, fusing traditions of East and West and borrowing elements from many religious traditions. But few artifacts from this remarkably cosmopolitan period survived Kashmir's Islamic sultanate in the late 14th century and the subsequent 16th-century Mogul conquest of the valley.

Alchi may provide crucial details about this lost world. For instance, the dhoti on one colossal statue—the

MAP: GUILBERT GATES

Bodhisattva Avalokiteshvara (see p. 72), who embodies compassion—is decorated with unknown temples and palaces. British anthropologist David Snellgrove and German art historian Roger Goepper have postulated that the images depict actual places in Kashmir—either ancient pilgrimage sites or contemporary buildings the artists knew. Because no large Kashmiri wooden structures from this period survive, Avalokiteshvara's dhoti may provide our only glimpse of the architecture of 12th-century Kashmir. Similarly, if the patterns painted on the Sumtsek beams are in fact designed to mimic cloth, they may constitute a veritable catalog of medieval Kashmiri textiles, of which almost no actual examples have been preserved.

Researchers aren't sure why the temples were built facing southeast, when Buddhist temples customarily face east, as the Buddha was said to have done when he found enlightenment. Nor is it known why the image of the Buddhist goddess Tara—a green-skinned, many-armed protector—was accorded such prominence in the Sumtsek paintings. Much about Alchi remains baffling.

ALTHOUGH IT IS LATE SPRING, a numbing chill pervades Alchi's Assembly Hall. Standing in its dark interior, Arya lights a small stick of incense and makes two circuits around the room before placing the smoldering wand on a small altar. Only after performing this purification ritual does he return to his camera. Arya is Hindu, though not "a hardcore believer," he says. "I must have done something seriously good in my past life, or seriously bad, because I wind up spending so much of my life in these temples."

He first came to Ladakh in 1977, to explore the mountains, shortly after tourists were first permitted to travel here. He later led treks through the area as a guide and photographer for a California-based adventure travel outfit.

For this assignment, he has brought an ultra-large-format digital camera that can capture an entire mandala, a geometric painting meant to depict the universe, in exquisite detail. His studio lights, equipped with umbrella-shaped diffusers to avoid damaging the paintings, are powered by a generator at a nearby guesthouse; the cord runs from the house down a narrow, dirt lane to the monastery. When the generator fails—as it often does—Arya and his two assistants are plunged into darkness. Their faces illuminated only by the glow of Arya's battery-powered laptop computer, they look like ghosts from a Tibetan fable.

But when the studio lights are working, they cast a golden glow on the Assembly Hall's mandalas, revealing stunning details and colors: the skeletal forms of Indian ascetics, winged chimeras, multi-armed gods and goddesses, and nobles on horseback hunting lions and tigers. Sometimes these details astound even Alchi's caretaker monk, who says he has never noticed these facets of the paintings before.

The concern about conserving Alchi's murals and buildings is nothing new. "A project for renovation and maintenance appears to be urgently called for," Goepper wrote in 1984. Little has changed.

In 1990, Goepper, photographer Jaroslav Poncar and art conservators from Cologne, Germany, launched the Save Alchi Project. They catalogued damage to its paintings and temple buildings—some portions of which were even then in danger of collapsing—and began restoration work in 1992. But the project ended two years later, the victim, Goepper wrote, of what he termed "growing confusion over administrative responsibility." Or, say others, between religious and national interests.

Although tourists now far outnumber worshipers, Alchi is still a living temple under religious control of the nearby

Writer and foreign correspondent **JEREMY KAHN** *and photographer* **ADITYA ARYA** *are both based in New Delhi.*

Likir Monastery, currently headed by the Dalai Lama's younger brother, Tenzin Choegyal. Monks from Likir serve as Alchi's caretakers, collecting entrance fees and enforcing a prohibition on photography inside the temples. (Arya has special permission.) At the same time, responsibility for preserving Alchi as a historic site rests with the government's Archaeological Survey of India (ASI).

Relations between the ASI and the Likir monks have long been fraught. The monks are wary of government intrusion into religious matters; the ASI worries the monks will undertake restorations that damage the Alchi murals. The result is a stalemate that has thwarted conservation efforts, going back to Goepper's.

The complex history of India's Tibetan Buddhist refugees also factors into the impasse. In the 1950s, a newly independent India sheltered Tibetans fleeing China's invasion of their homeland, including, eventually, the Dalai Lama, Tibetan Buddhism's religious leader as well as the head of Tibet's government. He established a government-in-exile in the Indian city of Dharamsala, a 420-mile drive from Alchi. At the same time, exiled Tibetan lamas were placed in charge of many of India's most important Buddhist monasteries. The lamas have been vocal in support of a free Tibet and critical of China. Meanwhile, the Indian government, which is seeking better relations with China,

Worry over the exquisite art—including an image of the protector goddess Tara—has fueled photographer Arya's efforts. "If tomorrow something would happen here, an earthquake or natural disaster, there will be nothing left," he says.

views India's Tibetan-Buddhist leaders and political activists, to some extent, as an annoyance.

Not long after arriving in Alchi to make photographs, Arya got a taste of the political conflict. One afternoon a local ASI official arrived at the monastery and demanded to see his authorization to photograph the murals. Apparently not satisfied with the documents (from Likir and the Central Institute of Buddhist Studies) that Arya produced, the official returned the next day and began to photograph the photographer. He told him that he planned to make a "report" to his superiors.

The encounter unnerved Arya. He considered suspending work on the project before deciding it was too important to abandon. "If tomorrow something would happen here, some earthquake or natural disaster, there will be nothing left," he told me.

In fact, powerful tremors had rattled the ancient temple complex about the time Arya arrived—the result of blasting a

little more than a mile from Alchi, where a dam is being constructed across the Indus as part of a major hydroelectric project. The dam project is popular. It has provided jobs to villagers and also promises to turn Ladakh, which has had to import electricity from other parts of India, into an energy exporter.

Despite ASI assurances that the blasting will not harm the ancient site, many worry it may undermine temple foundations. Manshri Phakar, an authority on hydroelectric projects with the South Asia Network on Dams, Rivers and People, an environmental group based in New Delhi, says he has documented houses that have suffered damage, and even collapsed, because of blasting associated with dam construction elsewhere in India. He also notes that building a dam just upstream from the monastery in a seismically active region poses extra risks; should the dam fail, Alchi could be catastrophically flooded.

"India has been gifted with so much art and so much history that we have lost our ability to recognize and appreciate it," Arya says. The Indian government "must take the risk of documentation"—the risk being that his photographs may encourage more tourism.

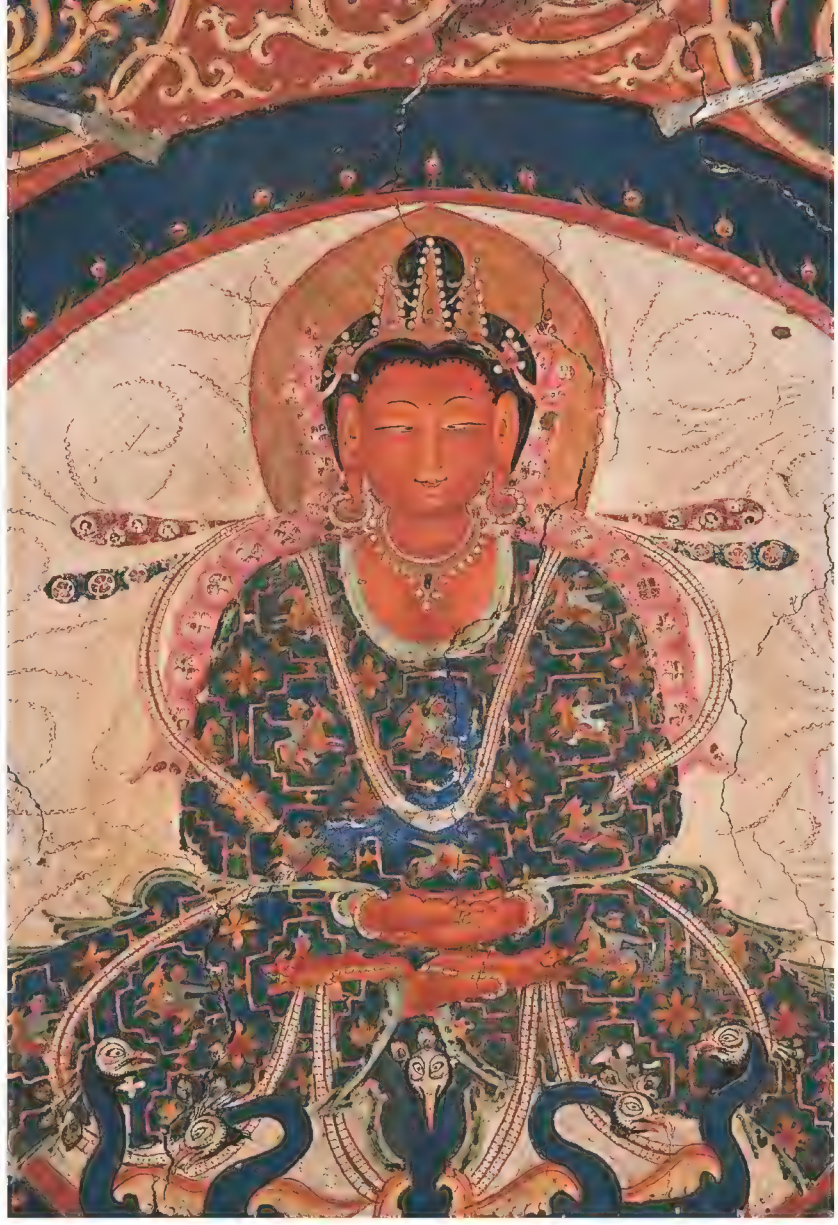
Arya would like to see his work displayed in a small museum at Alchi, along with written explanations of the monastery and its history. The monks, who sell postcards, give impromptu tours and have built a guesthouse for tourists, have been cool to that idea. "You have to understand that Alchi is not a museum," says Lama Tsering Chospel, the spokesman for Likir. "It's a *temple*."

Fifteen miles from Alchi is an example of a successful melding of tourism and conservation. In Basgo, a town on the Indus that was once the capital of Ladakh, three ancient Buddhist temples and a fort have been renovated through a village cooperative, the Basgo Welfare Committee. As in Alchi, the Basgo temples are considered living monasteries—in this case under the religious jurisdiction of Hemis, like Likir, a major Tibetan Buddhist "mother church." But in Basgo, the Hemis monastery, the ASI and international conservation experts have cooperated to save the endangered heritage. The project has received support from the New York-based World Monuments Fund as well as global art foundations. International experts have trained Basgo's villagers in conservation methods using local materials, such as mud brick and stone-based pigments.

Basgo's villagers understand the link between preserving the buildings and the local economy. "The survival of the town depends on tourism," says Tsering Angchok, the engineer who serves as secretary of the Basgo Welfare Committee. "Really, if tourism is lost, everything is lost."

In 2007 Unesco presented the Basgo Welfare Committee its award of excellence for cultural-heritage conservation in Asia. But Alchi's monks have shown little interest in adopting the Basgo model. "What purpose will that serve?" Chospel asks.

Jaroslav Poncar says that the Alchi monks' ambivalence can be traced to the paintings' strong Kashmiri influence and to their distance from contemporary Tibetan Buddhist iconography. "It is cultural heritage, but it is not *their* cultural heritage," says Poncar. "It is totally alien to their culture. For a thousand years, their emphasis has been on the creation of new religious art and not to preserve the old."



Failure to save Alchi's treasures (opposite: the 13-foot-high Bodhisattva Avalokiteshvara; above: Buddha Amitabha, ruler of the universe) has frustrated preservationists. Says Arya: "India has been gifted with so much art and so much history that we have lost our ability to recognize and appreciate it."

ARYA STANDS ON A LADDER PEERING into the viewfinder of his large-format camera. It is here on the Sumtsek's normally off-limits second floor that acolytes training to be monks would have advanced after having studied the massive bodhisattvas on the ground floor. No longer focused on depictions of the physical world, they would have spent hours sitting in front of these mandalas, reciting Buddhist sutras and learning the philosophical concepts each mandala embodied. They would study the images until they could see them in their minds without any visual aids.

Bathed in the warm glow of his studio lights, Arya, too, focuses intensely on the mandalas. He presses the shutter cable on his camera—there is a pop, a sudden flash and the room goes dark; the generator has blown again and all that remains of Alchi's technicolored wonders is the impression left on my retina, quickly fading. I am not a trained monk, and I cannot summon the mandala in my mind's eye. Then, glancing down, I see it again, a perfect image shining from the screen of Arya's battery-operated laptop—an image that will remain even if Alchi does not.

THE BEST BULL EVER?

Texas cattle breeder Donnell Brown hit the jackpot with a Red Angus named Revelation. Then his luck changed

BY JEANNE MARIE LASKAS PHOTOGRAPHS BY KAREN KASMAUSKI

On the R. A. Brown Ranch, fifth-generation rancher Donnell Brown can't help thinking about the potential he had created through decades' worth of work.

There once was a bull, an astonishing bull with a handsome, wide muzzle, stunning scrotal circumference and a square frame solid as a sycamore. He was the son of Cherokee Canyon, the grandson of Make My Day—a noble pedigree. The cowboy who designed him, who chose the semen, selected the dam, prepared and inseminated the uterus, named him Revelation. "We don't intend to present this bull as divine," the cowboy, Donnell Brown, would write in his 2005 sale catalog, "but we do count it a blessing to have raised him." Brown was a salesman by nature, but not given to hyperbole. He believed in his heart that Revelation, at just a year-and-a-half old, could become the most storied bull in the history of the Red Angus breed. Finally, after decades of tinkering: might this be the masterpiece?

Every October, cattle buyers from all over the United States gather near Throckmorton, in north-central Texas, where the R. A. Brown Ranch has been selling breeding cattle for more than a century, and where as many as 800 head will go at auction in a single day. Fathers, sons, grandsons—the ranch has passed through five generations. Donnell Brown, 41, is the current cowboy in charge, and at the 2005 R. A. Brown Ranch Bull & Female Sale he sold Revelation to a Houston businessman with a weekend ranch for $12,000.

In time, the bull could turn out to be worth much more. Top breeding bulls—once they're proven to produce prime calves—can sell for more than $100,000. In the breeding business, the buyer gets the animal, but the seller typically retains an interest in the genetics. Donnell kept the rights to half of Revelation's semen. It would be two years before anyone would know the quality of the bull's progeny.

Donnell wears creased Wranglers, a starched plaid shirt with long sleeves and a white hat with the brim cupped obediently up—not in some floppy, haphazard shape like East Texas cowboys wear. The spurs on his boots bear his initials, but he does not wear jingle bobs on them, those dangling silver baubles you see on flashy Arizona cowboys. No, cowboys in Throckmorton consider themselves *West* Texas cowboys: starched and ironed, just the way cowboys are supposed to be. Donnell is tall, slim, with a quarterback's build and the deep blue determined eyes of a man who is hanging on with all his might for the ride. No giving up on the four life goals he set for himself at age 23: *get to heaven; be the best possible husband and father; be healthy and happy; produce the most efficient beef cattle in the entire world by converting God's forage into safe, nutritious, delicious food for His people*. He wears a clean, straight mustache above an intelligent smile.

Two years after he sold Revelation, Donnell's dream came true: the bull's babies were at the top of the class. The weekend rancher from Houston didn't quite know what he had, so Donnell called him to explain.

"A superstar," Donnell told him, pointing out, as he often has to do, that a bull in today's marketplace is like a player in the NFL draft, except with a longer roster of stats. He told him that Revelation's progeny were showing beef marbling scores that were off the charts, along with breathtaking rib-eye areas. Producing a bull whose offspring have even one of these super stats is like hitting the lottery. But two? A near miracle.

"You should syndicate Revelation," Donnell advised, offering to bring the bull back to the R. A. Brown Ranch, where it would enjoy higher visibility, the conditioning of an athlete and Donnell's help in selling shares to investors. Word spread fast. Donnell and the rancher sold seven shares of Revelation for $1,650 apiece and had 14 more ranchers ready to pony up.

So of course Donnell felt blessed. Of course he was feeling something resembling pride when he went out on a routine cattle call one warm October morning in 2007 and looked around the east holding pasture.

"Come on, bulls!" Donnell cried. He sprinkled sweet grain on the brittle prairie grass, and the bulls gathered like children after the big piñata spill. All of them but one. "Come on, bull! Come on, buddy!" Donnell called to the slacker lying some 20 yards distant. It was Revelation. "Hey!" He went closer, and closer still. "Come on, buddy!"

Revelation lifted its head but otherwise remained as inert as a lump of clay. The bull could not get up. Donnell bent over to find that its right rear leg had been mangled, most likely in a fight with another bull, a battle for turf or just a boyish tussle for fun. Revelation was crippled, and a crippled bull is worthless. A crippled bull produces less and weaker sperm. A crippled bull is sent straight to the packinghouse.

"No," Donnell said. "Please God, no."

THE AVERAGE AMERICAN at the backyard grill who cares to think about the steak sizzling before him may imagine little beyond the packinghouse, where meat is cut and shrink-wrapped, or perhaps the feedlot, where beef cattle fatten up on corn on their way to market. But those are only two stops—relatively short and highly industrialized stops—in a long process. Before they get to the feedlot, cattle live the lives their bodies were built for: grazing beside their mothers on endless pastures at ranches called "cow-calf operations." These are independent ranches, about 750,000 of them in the United States, most of them with fewer than 50 head. The R. A. Brown Ranch, which has 2,000-odd head, belongs to a subset of these ranches that specialize in breeding: the "seedstock providers." They begin the beef production chain. The cowboys who run them are the inventors, the tinkerers who choose the genetics that determine the qualities of America's tenderloin, rib eye, sirloin, filet mignon and burgers.

April marks the earliest days in a commercial cow's life, and arguably the happiest. The calves at the R. A. Brown Ranch, just 6 to 8 weeks old, have been tagged and vaccinated, and now wander freely, chewing the wild grasses of Texas. The sunrise is so red it fills the sky with stripes of fire and turns the cowboy hats pink. Jeff Bezner, a 29-year-old cowboy with prematurely salt-and-pepper hair, glasses and an air of sparkling innocence, has the back of this cattle drive, while two other

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JEANNE MARIE LASKAS *has written five nonfiction books and is working on one about overlooked American workers.*
KAREN KASMAUSKI *has photographed stories on six continents.*

cowboys take the flanks. They keep the cattle in a clump, pushing them from pasture to paddock. Herding cows is not difficult, especially Red Angus, famously gentle and polite. (For a good time, try wrestling up some Brahmans.) The cows thunder obediently through the buffalo grass as the cowboys' horses amble and the men occasionally wave their arms, letting out a "Wheeet, wheeeet," or "Get on now, gals!"

"I never said nothing about *love*," Jeff says to his team, referring to the love he has, in fact, been talking about all morning. (Jeff wants a wife.) A cowboy on a cattle drive has time to ponder such matters.

"You've known her for a whole six days!" one shoots back.

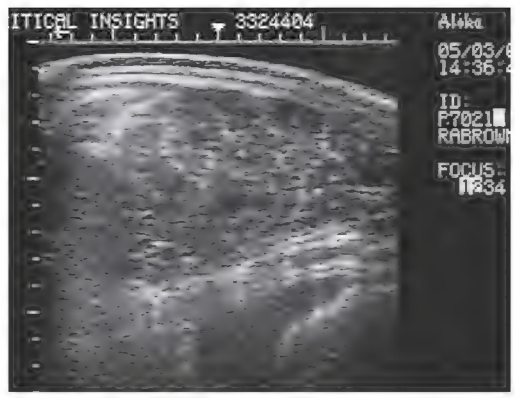
"Eight," Jeff says, slapping his chaps. "I'm telling you, she's awesome." He whistles through his teeth. The cattle move as one, a rumbling blanket of rolling amber, humming their lazy cow songs: *aaaroooom, aaaroooom, aaaroooom*.

Beef, even now, is still personal, is cultural, is *cowboys*.

It isn't like pork or poultry. Commercial pigs and chickens live their whole lives in industrial-size barns. Beef, in its beginning stages, will never be produced that way because a simple fact remains: all cows eat grass. You need land to

Donnell once described Revelation (left: in his right hand) as a "superstar"—a bull whose genes might have made cattle-breeding history. The rancher still owns AbiGrace (below), one of the most prized breeding cows in the Red Angus breed.

grow calves. Lots and lots of land. That land is divided among many owners. Beef production is unlike any other agricultural industry in that it has remained utterly dependent on the family farm or the extended-family farm, manned by the same people who sing in the church choirs and run the school boards and football leagues that knit the fabric of small towns like Throckmorton. Beef production is the largest single segment of American agriculture, a $76 billion industry, and yet more than 97 percent of U.S. cattle ranches are family-owned and -operated.



Ultrasound images provide a glimpse of the marbling of a bull's muscle.

The average American eats 62 pounds of beef a year, or almost three ounces a day, and shows no sign of slowing down; as a group, Americans regularly consume more than 27 billion pounds a year. This is, in part, a function of food science and the seed-stock providers: beef keeps getting tastier.

Beef is simultaneously low and high tech. Past necessarily coexisting with future. Because of the cowboys and because of the human desire for better meat.

To create the finest steaks, there really is nothing as important as a fabulous cow. Except, of course, an amazing bull.

Modern breeding requires an array of technologies: ultrasounds (above left: Brown ranch foreman Casey Zboril, in white hat, and technician Greg Mathiews) help determine fetal health; "straws," or doses, of bull semen (above right) are preserved in dry ice.

ON THE DAY HE FOUND REVELATION crippled in the east holding pasture, Donnell stood there feeling sick. Gut-sick, like a man watching his house burn down. In the silver liquid-nitrogen tank up in the ranch's artificial insemination center, he had only about 100 "straws," or doses, of Revelation's semen—hardly a gold mine.

He took his cellphone off his belt clip and called his wife, Kelli, back at headquarters.

"Oh, Donnell," Kelli said, desolated. She told Betsy, Donnell's sister, who works in the office, too, and soon word passed around the family.

All three of Donnell's siblings, and their spouses, share ownership of the ranch with him and Kelli. She serves as marketing maven and quiet, sturdy voice of wisdom—and as president of the Red Angus Association of America. Ranch headquarters is the small red house where Donnell grew up and now lives with Kelli and their two teenage boys, Tucker and Lanham.

In the end, Donnell decided no, he would not give up on Revelation. He would try to save his masterpiece. So he hauled the bull away in a trailer and drove five hours to a veterinary hospital near Austin, where he learned that Revelation had torn two ligaments, the anterior cruciate and medial collateral, in its right rear knee. "Nothing we can do for him here," the vet said, pointing Donnell to specialists at Kansas State University, 11 hours away. So Donnell got in the truck and drove. Revelation was like Barbaro, the racehorse. If ever there was an animal worth going the extra mile for, it was Revelation.

"We can try to construct a new knee," the Kansas vet said, with only vague encouragement in his voice. "Sure, we can try."

DONNELL'S PARENTS, ROB AND PEGGY, used to live in the red ranch house, but in 1998 they retired to the fancy house in town with the big columns out front, just as Rob's parents had done before them. Before she married Rob, Peggy's name was Peggy Donnell, and that's how Donnell got his name.

Rob, now 74, is himself legendary in the beef world; he played a vital role in determining the kind of steak America now eats. He came of age when the Hereford was the cattle of choice for the U.S. beef industry—a reliable, thrifty breed with far more muscle than the Texas Longhorn, its predecessor as America's main beef cow.

At Texas Tech, Rob had learned of a brave new world. "Continental breeds!" he said to his father, R. A., after he came home with his degree in agriculture in 1958. Breed a Hereford with, say, a Brown Swiss and get a larger carcass with, perhaps, the same quality meat—or better! Rob had other ideas, other breeds, other dreams. R.A., a man of tradition, would have

Branding (top: with an iron cooled in dry ice) and tagging (above left) are made easier by a hydraulic device that holds cattle in place. Smartphones (above right) help Donnell and his 13-year-son, Lanham, take care of business while out on the ranch.

none of it. Not until 1965 did he give Rob his reluctant blessing to crossbreed; within days, he died of a heart attack. If he hadn't given his assent, the ranch never would have enjoyed its explosive success in creating better and better meat.

Rob crossed a Hereford with a Brown Swiss and sure enough, he got cattle fully 100 pounds heavier at weaning, with the same hardiness as a Hereford. "Brilliant!" he thought. But the market did not quite agree. The cattle were not uniform in color, like the good old-fashioned amber Herefords. Some were brindle and some were gray. Coat color has nothing whatsoever to do with carcass quality, but even so, Rob's cattle were discounted at auction because they looked funny.

So Rob got back to work. He mixed his Herefords with Simmental, a different Swiss breed, and that solved the color problem. To that hybrid he added Simbrah, a Simmental-Brahman mix, to create cattle with heat tolerance. He added Red Angus for marbling. He got a planeload of Senepol from the Virgin Islands to add a gentle demeanor. And by 1989 he had a hybrid called the Hotlander, which is still popular among some breeding connoisseurs.

By then Rob's son, Donnell, was at Texas Tech, studying genetics. It's the Throckmorton way, after you grow up cowboying and playing football for the Throckmorton High Greyhounds (2005 state six-man champions!).

When he came home with his degree in 1993, Donnell said, "Dad, it's better to be on the leading edge than the *bleeding* edge." His father may have been ahead of his time, Donnell thought. He was creating superior beef, absolutely, but not necessarily beef the marketplace *understood*. Donnell brought science back from Texas Tech, but he also brought marketing.

Never a place for subtleties, the market understood one thing: Angus. Over the past quarter-century, brilliant marketing by the American Angus Association has made the

word "Angus" synonymous with "best steak in the world." Specifically Black Angus, even though Red and Black Angus carcasses are indistinguishable without the hide. But the American Angus Association promoted black, and so in today's market, solid black cattle, for reasons almost entirely psychological, bring top dollar.

"We have to create the meat that people want to buy!" was, and remains, Donnell's main point. Rob agrees, of course, but on the other hand he has the soul of an inventor and can't stop thinking of awesome new things to try. The father is the boy in this relationship. Donnell: buttoned-up, doing the right thing, selling it with a smile. Rob: trial and error and joy.

The R. A. Brown Ranch still offers its Hotlander composite, but Donnell directed the business toward an Angus focus, with a twist: become the premier Red Angus breeder, and have the genetics to prove it.

And he had those genetics in Revelation. *He had them.*

THE VETS WORKED ON REVELATION'S LEG for a year and a half. Surgery and rehab, surgery and rehab, and more surgery. Finally, in August 2008, the vet shook his head no.

"OK, then," Donnell said. "OK."

"It was like a close friend dying of cancer," he says today. "You're almost relieved when it's over. *Almost*."

He did not say goodbye. He sent Revelation to the packinghouse, where the prize bull became 1,200 pounds of hamburger. Sometimes, Donnell says, he wishes he could have saved Revelation's head like a deer's and mounted it. Sometimes he does think that way.

But mostly he thinks about Revelation's ear. He saved a notch from Revelation's left ear. He sent it to the ViaGen cloning lab in Austin. And there it sits, on ice.

TO ACHIEVE UNIFORMITY, and to maintain quality control, Donnell likes all his cows to be on the same estrus cycle. That's why, in April and May, during breeding season, a lot of them wear seeders—vaginal plugs carrying progesterone, each with a blue string for easy removal in a few days. The progesterone keeps the cows from coming into heat. When the plugs come out, each cow gets a shot of prostaglandin, which ultimately results in ovulation. At that point, one of the cowboys puts on an arm-length plastic glove and inserts an artificial insemination syringe loaded with 20 million sperm cells. George Self, who has cowboyed at the R. A. Brown Ranch for 57 years, is by far the best at this. "He has a gift with his hands to know how to feel into a cow that most people don't have," Donnell says. George will feel the reproductive tract with one arm, then with the other hand, guide the syringe through the cervical rings (the tricky part) and deposit the semen at the opening of the cervix. It takes maybe 60 seconds per cow, and every cow on the ranch, 1,300 in all, is bred that way, as many as 400 in a single day.

The finest cows, the genetically superior ones, are put on a different regimen. AbiGrace is the Browns'—and the breed's—rock star in this category. She will be overstimulated for maximum egg production and inseminated with choice sperm. The resulting embryos, as many as a dozen, will be flushed and frozen. Donnell could sell those embryos for more than $1,000 a pop on the Internet if he chose, but usually they are inserted into surrogate cows—proven dams that don't, let's say, have the genetics to be worth breeding. AbiGrace can then be stimulated to make more embryos, and more still.

Without scientific assistance, a mature cow will produce one calf a year; with embryo transfer, AbiGrace can crank out 25.

CLONING REVELATION IS A BIG DECISION, and Donnell does not know what to do. He has never cloned a bull before, never imagined himself stuck in the mud of such profound uncertainty. For about $20,000, an exact genetic replica of Revelation could be engineered in the lab and soon enough be out there grazing on the silver bluestem. Actually, technically, Donnell could order up two new Revelations, or 20 Revelations, or more. But: "There's the question of playing God," he says, "and there's also just the business model to consider. Like I tell my dad, it's better to be on the leading edge than the bleeding edge."

Donnell stares at the horizon a lot; he spends all day in his truck, so many days in his truck, covering hundreds of miles a day sometimes to look at bulls or pick up cows. On this April afternoon he's just returning from a ranch in Coleman, Texas, where he transferred 70 valuable Red Angus embryos into some surrogates. He's headed down to his ranch's artificial insemination center to check on the action there.

He parks. He notices a splotch of dried mud on his

starched jeans. He takes out a knife he keeps clipped to his belt, unfolds it and scrapes that mud right off.

The artificial insemination (AI) center is a modest white tin barn surrounded by a catacomb of pens and clanking red gates. It's at the far end of the ranch, flanked by shady hills providing cool comfort to hundreds of cattle. Atop the hill, a lone oil derrick bounces its lunatic head up and down.

Inside the AI center, the main event is the mighty gray metal chute, a monstrous contraption that can, with the benefit of hydraulics, hold a cow or a bull in place. Then a cowboy can do what he needs to do: inseminate, castrate, brand, palpate.

Today, a freelance cowboy who specializes in ultrasound technology is here with his machine, which is connected to a computer, which is connected to a thumb drive, which contains information that will eventually be uploaded to a lab in Iowa. Technicians there will run a program to translate the images into numbers.

"Howdy, sir!" Donnell says, all smiles.

"How's your boy?" the cowboy says. "He's playing ball next year?"

"You spying for another team?" Donnell says with a laugh.

The ranch's hired hands, including Jeff Bezner (left: carrying a fence-post driver) and Tony Martinez, still live the life of a cowboy. Donnell Brown (below) surveys the herd with his father, Rob, who gained fame as an innovative crossbreeder.

"Yes sir, Tucker's looking to play quarterback. We're proud of him, mighty proud of him."

"I'm about through with these bulls," the cowboy says, holding on to a humming electric shaver. "About a half-dozen left. Seeing some good scores." He's shaving some hair from the back of a 926-pound young bull. He squirts a shot of lubricant on the hide, then gently places his ultrasound wand over a spot between the 12th and 13th ribs. The image that emerges on his computer screen is unmistakably and perhaps unsettlingly a rib-eye steak. Clear as on a plate.

"Nice marbling," Donnell says. "OK, *real* nice."

The cowboy then gets a shot of the bull's back fat. All carcasses are trimmed to the industry standard of a quarter-inch of body fat, so you're hoping to see that score low, and marbling high. The complete examination takes less than five minutes, and when the ultrasound cowboy is through he pulls a lever, releasing the bull. The bull roars out while another thunders into the chute with a great clank and clatter.

Once processed into numbers, the data will go to the Red Angus Association of America, where a cowboy like Donnell can pull them up on his Blackberry: the Expected Progeny Differences (EPDs) of one bull versus another and one cow versus another. A herd's full set of EPDs reads like endless pages of Nasdaq offerings, a chart of numbers expressing the relative values of carcass weight, marbling, rib-eye area, fat thickness, maternal milk, cow energy value, calving ease, birth weight, weaning weight, yearling weight—14 traits in all—that each animal's progeny has been statistically predicted to achieve.

Donnell spends hours in his truck, but not always alone.

EPDs can be difficult for the weekend rancher to master, but for a modern seed-stock provider like Donnell the information is gold. Get a dam with the best EPDs for calving ease and cow energy value, and breed it with a bull with the best EPDs for marbling and rib-eye area and maybe weaning weight times yearling weight (an online EPD Mating Calculator can help with this task), and see if you can't just produce perfection. Tweak with the next generation, and try again, and again.

And then one day you find you have created something no cowboy has ever created before. Of course you name it Revelation. And of course, when it gets crippled, you do everything in your power to save it. And of course if you lose the battle and have to send it to slaughter you . . . clone it. Really? *Really?*

To date, no more than a thousand cattle have been successfully cloned in the United States, and market reaction has been mixed. People aren't sure they want to eat cloned beef.

But still. It's . . . Revelation! It's Donnell's masterpiece. Of course, to clone the bull he would need the approval of all seven ranchers who own shares in the syndicate.

Late one summer night, Donnell sits at his computer, and he types an e-mail to them, and he reads it over to make sure it sounds right. He pauses awhile. Nothing to lose by just putting the question out there, right? Nothing to lose.

AND NOW IT IS OCTOBER, and a beautifully wet one at that. Throckmorton averages just 26 inches of rain a year, and so drought is a constant concern; all this precipitation feels like a blessing, greening fields of wheat and refilling water holes. The 2009 R. A. Brown Ranch Bull & Female Sale is just a few weeks away. The leadoff bull is Turbo, son of Destination, great-grandson of Cherokee Canyon, great-nephew of Revelation. He has impressive EPDs—the highest inner-muscular fat score of any bull in the sale.

"Turbo charge your program," Donnell wrote on Page 67 of the sale catalog. "Thrust your program to the forefront of the fastest-growing breed in America with Turbo." He expects $20,000 for the bull, plus an average of about $3,000 apiece for the 500 others.

And if all that isn't enough good news, the Throckmorton Greyhounds are undefeated through seven games with Tucker Brown as quarterback.

Plus Jeff has a new girlfriend. Actually, two. The eight-day relationship did not work out, but now there is Hannah and there is Fatima. Hannah is pretty much perfect in every way but, Jeff says, she's busy as a tick. The Fatima situation makes no sense whatsoever. She lives off in the Dallas-Fort Worth metroplex, goes to happy hours and movies. She'd never even met a cowboy before Jeff. *Makes no sense at all!* How is it that they talk forever on the phone? *Forever.* He's honest with her. He says: "There is Hannah." He says: "I'm Christian and you're Muslim. How would that deal work out? What would we do with our kids?" He says: "I'm not moving to no metroplex." He says: "I'm a cowboy."

Fatima drove all the way up from Dallas the night before—150 miles—to bring Jeff a present.

"What does a city girl know about a cowboy shirt?" Jeff is saying about the gift the next morning at the saddle house.

"You should have just told her thank you," one of the other cowboys offers.

"But I didn't *understand* it. I'm like *huh?* It had these shoulder flap deals. I'm like, what are these *for?*"

"You should have just said thank you."

"She said she got it from some top-notch store," Jeff says. "Norbert's?"

At sunrise, the Brown ranch cowboys leave the saddle room. With another breeding season done, Donnell awaits the results.

"*Nordstrom's*!"

Donnell walks up.

"Morning, gentlemen!" he says. "Ready to roll?"

"Yes, sir," Jeff says. "We'll get 'er loaded here in a moment."

They're headed to a ranch rodeo five hours away, for working cowboys only—not those highly paid professional bull riders you see on TV. This is ranch versus ranch, all the cowboys testing the skills they actually use each day. Roping, doctoring, milking, bronc riding. (No bull riding, because no working cowboy would ever have reason enough—or be stupid enough—to climb on the back of a bull.) Jeff will ride bronc tonight. On one hand it's an honor to be the bronc rider but on the other hand it's what you give to the young guy with no wife and no kids. Just in case.

They will take separate trucks, Donnell alone in his, because the others know better. Donnell can easily turn a five-hour trip into a ten-hour trip. *Easily.* He likes to stop and chat with customers. He'll pass out sale catalogs and hang posters of Turbo at sale barns, feed stores, any place that looks good. He has a roll of tape in his truck.

Soon he is alone on Highway 183. A pickup approaches in the opposing lane and he raises two fingers, waves. He will do this over and over again, every truck he sees, until he reaches a town with too many to greet. Then, on the other side of that town he will wave again, truck by truck.

All the investors have said yes to the idea of cloning Revelation. Sometimes Donnell wishes one of them had said no. Sometimes it's easier when God takes choices *away* from you. It's up to Donnell now, up to him to call the lab.

His dad said no. Actually, his dad said, "Nah," as in, *Why in the world would you spend all that money on some dumb clone?* It's funny. Because his dad is the one who always wants to try awesome new things, and Donnell is the one clinging to good, conservative sense. You'd think their positions would be reversed.

But here's his dad's point: a better bull is on the horizon. Something even more amazing than Revelation will come along, so put your faith and your prayer and your energy there. In the future. Not the past.

It's a tough one for Donnell to get. He's a cowboy. A cowboy holds on to what is known and correct. It's good to look forward, of course it is. But it's hard to look forward when the past was so perfect.

He may yet decide to clone. He may not. But instead of idling, stuck in the mud of indecision, he thinks: Revelation plus AbiGrace. The top Red Angus bull. Donnell has the semen. The top Red Angus cow. He has the eggs.

And now he has the resulting embryos in 16 surrogate cows. This April, when the calves drop to the ground, he'll see what he gets. He'll see. Anyway, right now, he wishes he thought to bring a staple gun. Because tape won't stick to a corkboard, and that's the only place at this particular feed store where he's allowed to put a poster. Other posters of other cattle are using up all the tacks, and he is not a man to take down another man's poster.

He needs a staple gun, so he finds a Super Wal-Mart and pulls into the parking lot. He has on the spurs he won riding bronc at a ranch rodeo in 1989. He has on his fancy embroidered shirt. He notices a splotch of dried mud on his jeans. He takes out the knife he keeps clipped to his belt, unfolds it and scrapes. He reaches into the back of his truck, grabs his hat, the handsome black felt one he brings out each fall. He puts the hat on his head, positions it low, walks tall and listens to the gentle jingle of his spurs.

In this way, all dignity and elegance and fight, a cowboy enters Wal-Mart on an October afternoon full of steam, the way of sunshine after rain.

Unusual Suspect

Why did Lewis Carroll's reputation undergo such a dramatic reversal? **BY JENNY WOOLF**

THE REV. CHARLES LUTWIDGE DODGSON was a teacher of mathematics at Oxford and a deacon of the Anglican Church. Some colleagues knew him as a somewhat reclusive stammerer, but he was generally seen as a devout scholar; one dean said he was "pure in heart." To readers all over the world, he became renowned as Lewis Carroll, the author of *Alice's Adventures in Wonderland*.

Biographers disagree over what kind of man Charles Dodgson (c. 1860) really was.

CHARLES LUTWIDGE DODGSON / SSPL / GETTY IMAGES

Alice was popular almost from the moment it was published, in 1865, and it has remained in print ever since, influencing such disparate artists as Walt Disney and Salvador Dali. Tim Burton's *Alice in Wonderland,* just released in movie theaters nationwide, is only the latest of at least 20 films and TV shows to be made from the book. But if *Alice* has endured unscathed, its author has taken a pummeling.

Since the 1930s, biographers and scholars have questioned the nature of Dodgson's relationship with the 10-year-old girl to whom he first told the story, and since the 1960s his work has been associated with the psychedelic wing of the countercultural movement. When some of Dodgson's photographs—he was an accomplished portraitist—were exhibited in 1999, a *New York Times* reviewer quoted Vladimir Nabokov (who had translated *Alice* into Russian) as saying there was "a pathetic affinity" between the photographer and the pedophilic narrator of Nabokov's novel *Lolita*. Tim Burton recently described Dodgson's stories as "drugs for children" and Wonderland as a place where "everything is slightly off, even the good people."

The decades of interpretation and reinterpretation have created a widening chasm between how modern readers perceive the author and how they receive his work. "Lewis Carroll is treated like a man you wouldn't want your kids to meet," says Will Brooker, author of *Alice's Adventures: Lewis Carroll in Popular Culture*, "yet his stories are still presented as classics of pure, innocent literature." As Burton's movie beckons us down the rabbit hole once again, it

might be wise to ask: How did we arrive at this curious state of affairs?

CHARLES DODGSON was born in 1832 in Daresbury, a village in northwest England, the third child (and first son) of Charles Dodgson, an Anglican clergyman, and his wife, Frances. As the household grew to include 11 children, Charles did not lack for company. "He told his brothers and sisters stories, made up games and wrote magazines with them," says Edward Wakeling, who spent 12 years annotating Dodgson's diaries. Later in life, "he really enjoyed entertaining children, and they loved him in return."

After enrolling at Oxford in 1850, at age 18, Dodgson became a "senior student"—the equivalent of a fellow—at the university's College of Christ Church. According to college rules, senior students had to be ordained as priests and take a vow of celibacy; Dodgson evaded the ordination rule and lived at the college unmarried, until his death in 1898, less than two weeks before his 66th birthday.

Alice Liddell, who urged Dodgson to write down the story that became *Alice*, posed for him, age 6, as a beggar (1858).

Like many Victorian bachelors, he became a sort of uncle to his friends' children, making up stories and games and taking them on short trips; the role ensured him a warm welcome in many homes. In 1855, dean Henry Liddell arrived at Christ Church with his wife, Lorina; their son, Harry, and daughters Lorina (or "Ina"), Alice and Edith. (The Liddells would have five more children.) Before long, Dodgson struck up a friendship with Harry, then 9.

"He taught Harry rowing and arithmetic, spent time with him and took him on outings," says Wakeling. As Harry's sisters grew older, he says, "Dodgson also took them under his wing, with their parents' blessing."

Dodgson particularly liked to pack a picnic lunch and take the Liddell children boating on the Thames, with adult friends or family to share in the rowing. On a July afternoon in 1862, he took the three Liddell sisters on a stretch of the river between Oxford and Godstow and told them the story that would become *Alice*. Alice Liddell, then 10, was delighted that the main character bore her name and asked Dodgson to write down the story.

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As Freudians weighed in on *Alice*, one analyst wrote that the meaning of an illustration depicting the title character was "almost too obvious for words."

At this time, Dodgson was taking photographs. Although the camera was still a relatively new technology, he had been an early enthusiast, starting in 1856, and he found no shortage of friends who wanted him to make likenesses of them or their children. Alfred, Lord Tennyson, England's poet laureate, befriended the then-obscure don and let Dodgson photograph him after becoming impressed by one of his child portraits. "You, I suppose, dream photographs," he said.

Of the approximately 3,000 photographs Dodgson made in his life, just over half are of children—30 of whom are depicted nude or semi-nude. Some of his portraits—even those in which the model is clothed—might shock 2010 sensibilities, but by Victorian standards they were . . . well, rather conventional. Photographs of nude children sometimes appeared on postcards or birthday cards, and nude portraits—skillfully done—were praised as

GRANGER COLLECTION, NEW YORK

art studies, as they were in the work of Dodgson's contemporary Julia Margaret Cameron. Victorians saw childhood as a state of grace; even nude photographs of children were considered pictures of innocence itself.

In discussing the possibility of photographing one 8-year-old girl unclothed, Dodgson wrote to her mother: "It is a chance not to be lost, to get a few good attitudes of Annie's lovely form and face, as by next year she may (though I much hope won't) fancy herself too old to be a 'daughter of Eve.' " Likewise, Dodgson secured the Liddells' permission before taking his now-famous portrait of Alice at age 6, posing as a beggar child in a tattered off-the-shoulder dress; the family kept a hand-colored copy of it in a morocco leather-and-velvet case.

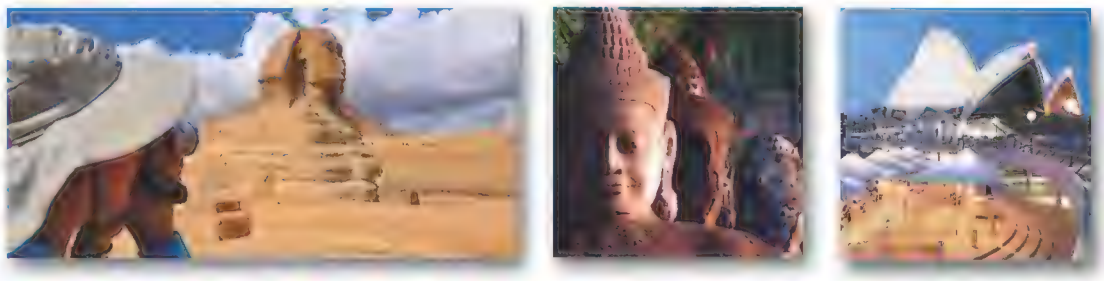
Dodgson's relationship with the Liddells apparently hit some kind of pothole in June 1863: he stopped seeing both the children and their parents for several months. And although he resumed socializing with the dean and his wife, he never took their daughters out again. In 1864, however, he did give Alice a present: a bound manuscript titled *Alice's Adventures Under Ground*.

The next year an expanded version of the story was published as a book, *Alice's Adventures in Wonderland*. It quickly made the name "Lewis Carroll" famous. He published a sequel, *Through the Looking-Glass and What Alice Found There*, in 1871, and a long-form nonsense poem, *The Hunting of the Snark*, in 1876.

Dodgson's identity as *Alice*'s author was an open secret, and the author gathered about him a large circle of affectionate children and their parents. His slight air of mystery added to his fame, which spread by word of mouth. Eventually he was invited to entertain two grandchildren of Queen Victoria herself.

He retired from teaching mathematics in 1881. While visiting some of his sisters in Guildford, just outside London, in 1898, he became ill. He died there of pneumonia on January 14 of that year.

By then, Dodgson's reputation as a merry, child-doting—and entirely proper—maker of nonsense needed little



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burnishing; the *London Daily Graphic*'s obituary noted that "like many bachelors, he was very popular with children and very fond of them." Before the year was out, Dodgson's nephew Stuart Collingwood published a biography that devoted two effusive chapters to Dodgson's many "child friends," including references to his hugging and kissing girls, and largely omitted references to his many friendships with women.

"The popular Victorian image of Lewis Carroll was of a sort of child-loving saint," says Brooker. "It is an image which Dodgson himself helped to create, and it suited Victorian attitudes."

In 1932, the centennial of Dodgson's birth, Alice Liddell, then an 80-year-old widow, traveled with her son and sister to New York City to receive an honorary doctorate from Columbia University for "awaking with her girlhood's charm the ingenious fancy of a mathematician familiar with imaginary quantities, stirring him to reveal his complete understanding of the heart of a child." An informal group of his admirers commemorated the centennial by praising Dodgson as a "great lover of children" and raising the equivalent of almost $800,000 in today's currency to fund a Lewis Carroll children's ward at St. Mary's Hospital in London. That may have been the last time he was so simply remembered.

THE NEXT YEAR, a writer named A.M.E. Goldschmidt presented at Oxford an essay titled "Alice in Wonderland Psycho-Analysed," in which he suggested that Dodgson was suppressing a sexual desire for Alice. (Her fall down the well, he wrote, is "the best-known symbol of coitus.") Goldschmidt was an aspiring writer, not a psychoanalyst, and some scholars say he may have been trying to parody the 1930s vogue for Freudian ideas. Whatever his intent, unambiguously serious writers picked up the thread.

"We are reasonably sure that the little girls substitute for incestuous love objects," wrote New York University professor Paul Schilder in 1938. The meaning of an illustration of a long-

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Alice Liddell (in 1872, about age 20) did not speak with biographer Florence Becker Lennon. But her sister Ina did.

necked Alice is "almost too obvious for words," psychoanalyst Martin Grotjahn offered in 1947. Similar analyses would appear as the literature on the *Alice* author grew.

In 1945, Florence Becker Lennon advanced the case that Dodgson had had an unhealthy attraction to Alice with *Victoria Through the Looking Glass*, the first modern critical biography of him. "People have wondered what he did with his love life," Lennon wrote. "Now it can be told. He loved little girls, but, like Peter Pan, he had no intention of marrying them." But Alice, she wrote, "was the first and most favoured of his girl friends," and she speculated about the idea that Dodgson precipitated the rift with the Liddells by proposing "honourable marriage to [Alice] directly or through her parents" in 1863. Alice was 11 then—too young, even by Victorian mores.

Lennon's basis for the assertion may have seemed sound: Ina was one of her sources. (Alice did not talk to Lennon because, her sister said, she was ill.) But in a letter to Alice, Ina wrote, "I tremble at what I said" to Lennon about the Liddell family's supposed rift with Dodgson. "I said his manner became too affectionate to you as you grew older and that mother spoke to him about it, and that offended him, so he ceased coming to visit us again." Ina

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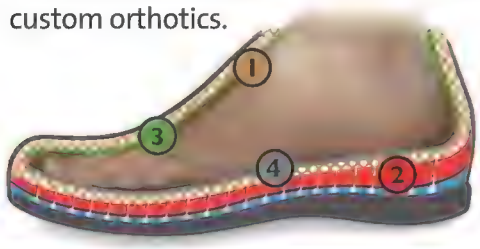

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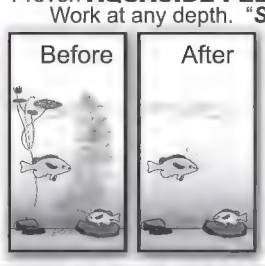

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had also told Lennon that she, Ina, was 10 at the time—but she was 14, or old enough to entertain formal suitors.

Whether Ina was mistaken, duplicitous or confused when she spoke with Lennon, her letter to Alice does not say. (One conjecture is that she lied to conceal Dodgson's interest in her, or hers in him; given his finances and prospects at the time, her parents would have discouraged the match.)

The idea that Dodgson had an unhealthy involvement with Alice has persisted, although there is no evidence to support it. Three major biographies published in the 1990s, by Donald Thomas, Michael Bakewell and Morton Cohen, suggested that he had pedophilic urges but never acted on them.

Lennon acknowledged that she wrote without the benefit of Dodgson's diaries, which were published in abridged form in 1954 and in full, with Wakeling's annotations, beginning in 1993. But even they are an imperfect source. Four of the 13 volumes are missing—as are the pages covering late June 1863, when his break with the Liddells occurred. A Dodgson descendant apparently cut them out after the writer died.

But if the diaries offer nothing about his romantic interests, other documents do.

One is a note, purportedly written by one of Dodgson's nieces, summarizing what was in the missing diary pages from 1863: "L.C. learns from Mrs. Liddell that he is supposed to be using the children as a means of paying court to the governess—he is also supposed . . . to be courting Ina," it reads, meaning that the children's mother told him that people were gossiping about him, saying he was courting either the Liddells' governess or their eldest daughter.

In addition, Dodgson's surviving letters suggest that he had a keen interest in women—and worked to circumvent the Victorian proscription of mingling between unmarried adults of the opposite sex.

"I wish you could come and stay here a bit!" he wrote to 22-year-old

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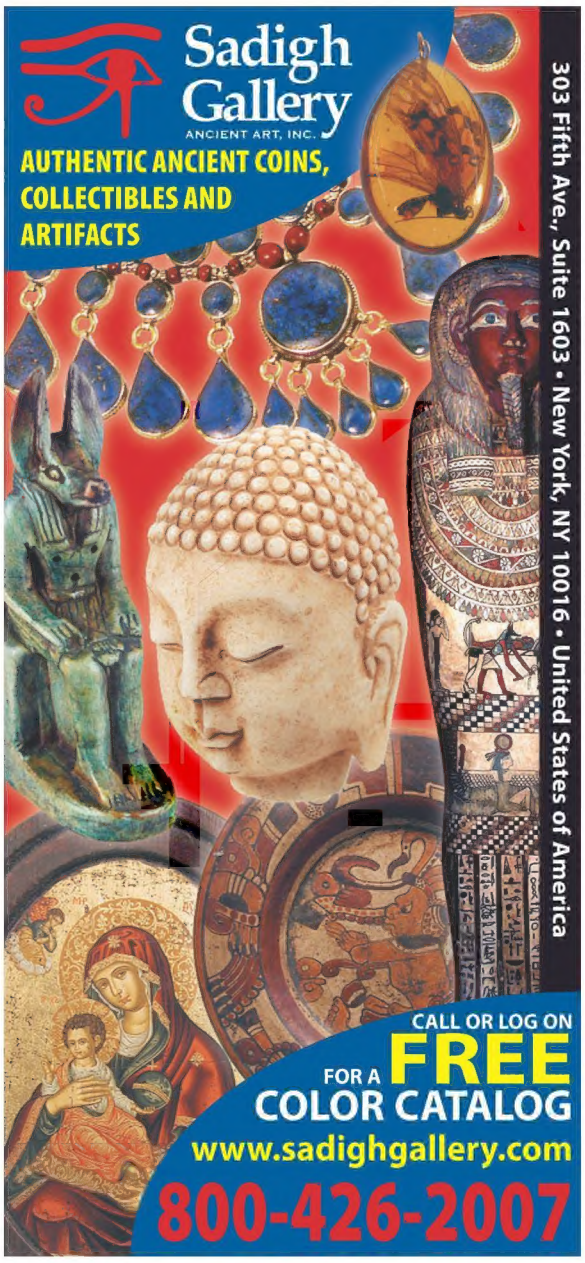
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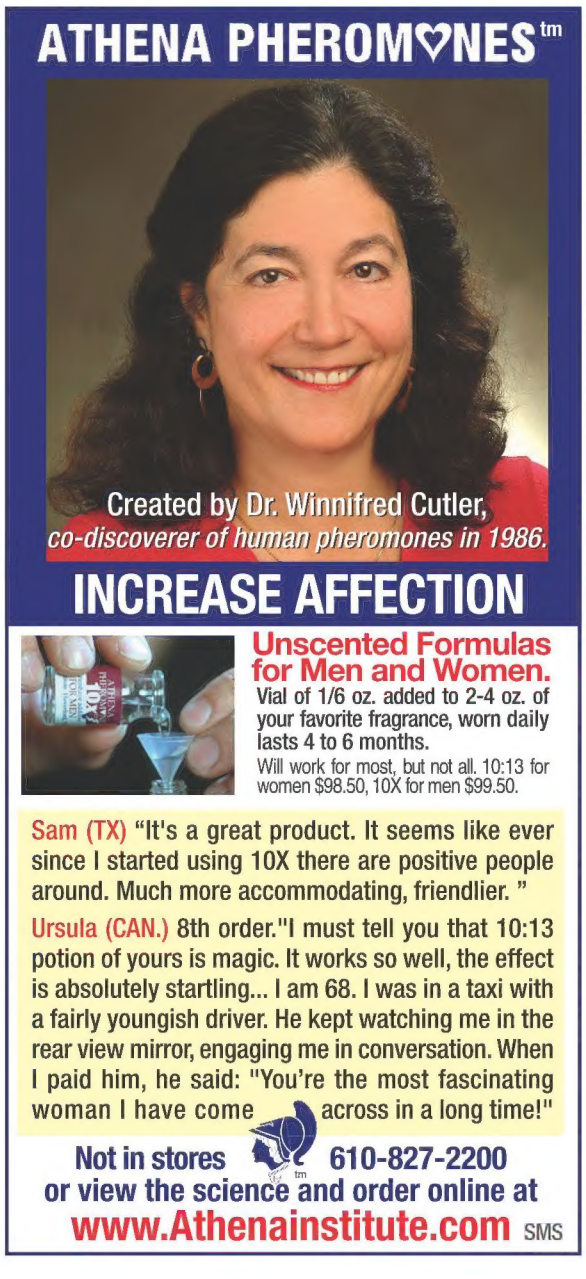
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Edith Rix in 1888. "I believe the 'Mrs. Grundy' risk might be altogether avoided by simply arranging 2 or 3 visits to be paid consecutively." (Mrs. Grundy was British society's fictitious guardian of morality.) In 1879, he asked Gertrude Thomson, a new acquaintance in her late 20s, "Are you sufficiently unconventional (I think you are) to defy Mrs. Grundy, and come down to spend the day with me at Oxford?" (She was, and did.) In a 1967 memoir, the stage designer Laurence Irving, a son of one of Dodgson's friends, summarized Oxford gossip from previous decades in dubbing him a "greying satyr in sheep's clothing."

In 1999, Karoline Leach published yet another Dodgson biography, *In the Shadow of the Dreamchild,* in which she quoted the summary of the missing diary information and argued that her predecessors, misunderstanding the society in which Dodgson lived, had created a "Carroll myth" around his sexuality. She concluded that he was attracted to adult women (including Mrs. Liddell) after all.

The reaction among Dodgson scholars was seismic. "Improbable, feebly documented . . . tendentious," thundered Donald Rackin in *Victorian Studies*. Geoffrey Heptonstall, in *Contemporary Review*, responded that the book provided "the whole truth."

Which is where Dodgson's image currently stands—in contention—among scholars if not yet in popular culture. His image as a man of suspect sexuality "says more about our society and its hang-ups than it does about Dodgson himself," Will Brooker says. We see him through the prism of contemporary culture—one that sexualizes youth, especially female youth, even as it is repulsed by pedophilia. The nature of his relationships with Alice, with other girls and with women may never be established with certainty. But then, uncertainty is a consistent theme in the *Alice* books.

JENNY WOOLF, *a London-based journalist, is author of the recently published* The Mystery of Lewis Carroll.

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Like a Dog in a Canoe

A novice's guide to foreign idioms **BY TOM BODETT**

SOME YEARS BACK I WAS invited to speak at a black-tie event for the French-American Chamber of Commerce at the Plaza Hotel in New York City. Because the audience would be primarily French nationals, I was advised to avoid using American idioms in my address. This is a fine kettle of fish, I thought as I sat down to purge my vocabulary of American idioms. What I was left with at the end of the day was "Good evening," "Thank you" and a rented tuxedo.

I'd have sold the farm back then for a peek into Jag Bhalla's 2009 book, *I'm Not Hanging Noodles on Your Ears, and Other Intriguing Idioms From Around the World*. Had I done so, I could have substituted French idioms for the English ones that make up way too much of my working vocabulary.

Imagine the audience's delight had I told them how I felt *my butt was fringed with noodles* (very lucky) to be there. These noodles, by the way, would be different from those *hanging on my ears*—a Russian expression meaning, "I'm not pulling your leg." I'm not pulling your leg.

The French nationals gathered at the Plaza clearly *had their butter, money for the butter and the woman who made it* (had it all). But, some of them also *had a glass up their noses* (one too many). No doubt I would have *had their posteriors banging on the ground* (laughing hysterically) if only I'd read Bhalla's guidebook.

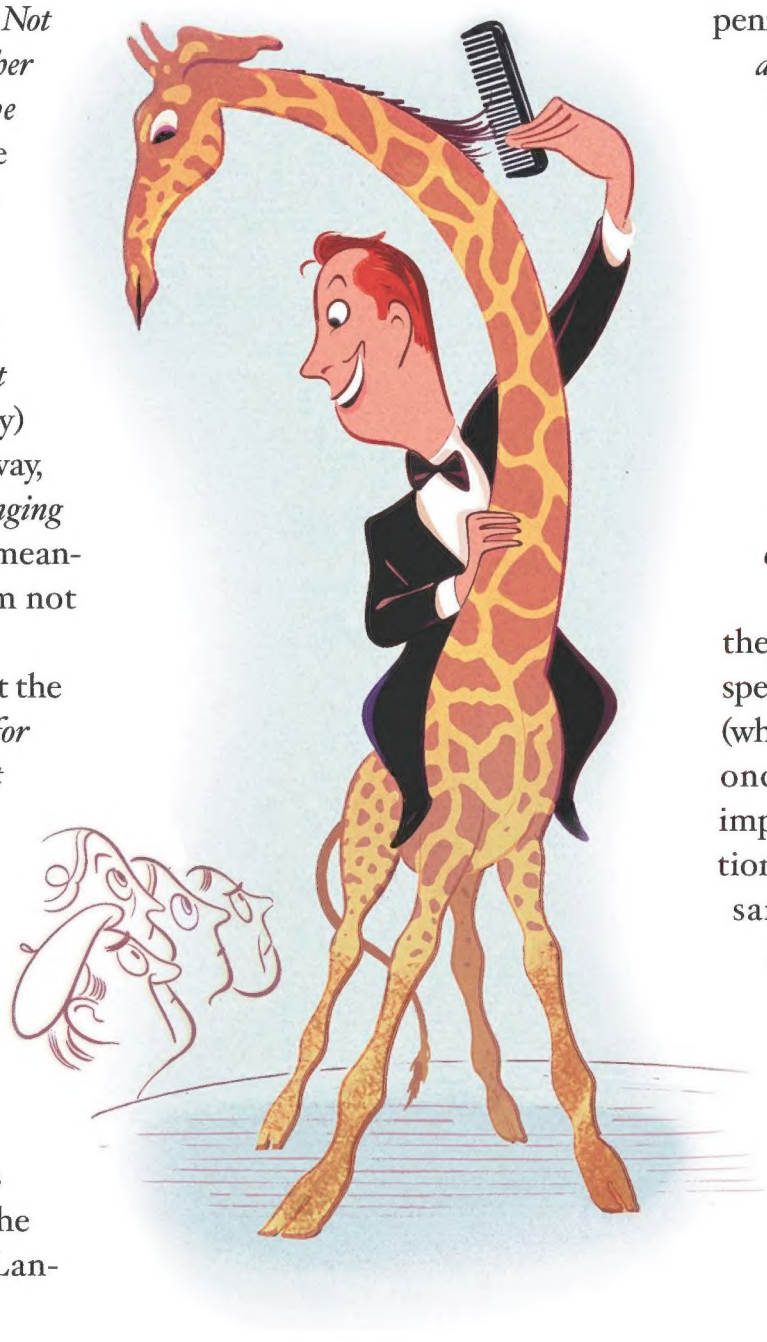
I'm Not Hanging Noodles on Your Ears does more than catalog humorous world idioms. It presents an often-confounding glimpse at the inner soul of foreign cultures. "Language most shows a man," the British playwright Ben Jonson once wrote. "Speak that I might see thee." But what do I see when I hear that a Colombian who is hopelessly in love has been *swallowed like a postman's sock,* or that *drowning the fish* in France is to lose by deliberate confusion? I have no idea how to use the phrase, but I can't wait to try it, even if I drown the fish in the attempt.

In fact, there are dozens of foreign idioms we could put to good use in these parts. When talking about misers, we typically resort to *cheapskate*. But I like it that in Syria, a penny pincher is better known as an *ant milker*. (Not to be confused with a German *mouse milker*, who in the United States would be called a micromanager.)

That nervous boy at the door to pick up your daughter would be *like a dog in a canoe* in Puerto Rico. And if he had to be shown the door at the end of the evening he could leave mainland Spanish style and *go out by the neck of the shirt*.

As for my French friends, they're likely to invite me back to speak *in a week with four Thursdays* (when hell freezes over). Then I will once again *bite the moon* (try the impossible) on behalf of international bonhomie. Am I pounding sand down a rathole? "*Au contraire,*" the French might say. I am *combing the giraffe* (wasting effort).

Good evening, thank you and pardon my French.



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TOM BODETT *is a humorist and author living in Vermont.*